ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE,

BOMBAY PRESIDENCY.

FOR THE YEAR

1914-1915

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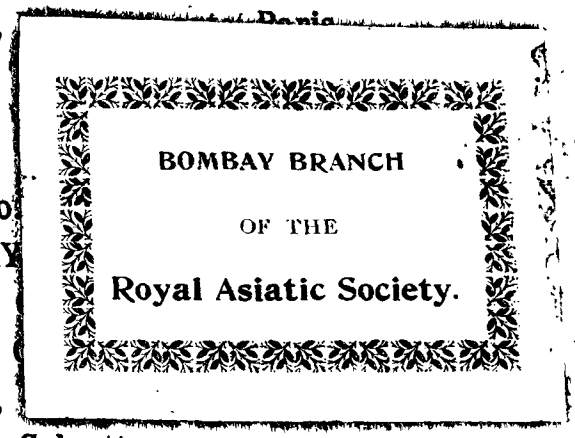

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No. A.—11964 of 1915.

From

G. F. KEATINGE, Esq., C.I.E., I. C. S.,
Director of Agriculture, Bombay,
Poona;

To

THE CHIEF SECRETARY TO GOVERNMENT,
Revenue Department,
Bombay.

Poona, 30th December 1915.

Sir,

I have the honour to submit the annual report for the Agricultural Department for the year 1914-15.

CHAPTER I.

ADMINISTRATIVE.

2. During the year the expenditure of the Department was Rs. 8,53,412 as against an expenditure of Rs. 7,78,861 of the preceding year, an increase of Rs. 74,551, the major portion of which, Rs. 52,000, represented the cost of the steam plough purchased for Gujarát, the rest representing the increase of salaries due to progressive posts. There was an increase in expenditure under hydraulic experiments, but the expenditure under other heads remained about stationery, and in some instances was considerably cut down. It was, therefore, not possible to make much development in new directions, but the following sums received from or promised by trustees or individuals during the year for the furtherance of work which we have inaugurated enabled us to commence or project new work, *viz.*—

	Rs.
Sir Sassoon David Trust Fund	38,730
King Edward VII Memorial Fund, Kánara	15,000
Mr. Rájárám Báláji	5,000
Mr. Vithuji Khanduji Pisál	1,000 a year.
District Local Boards	1,728

These generous contributions were very welcome at the present time both on account of the financial assistance which they gave and as marking an appreciation on the part of the public in the work of the Department. The Departmental receipts credited to Government amounted to Rs. 1,01,000.

3. In the upper ranks there was a considerable change of staff owing to leave vacancies and transfers. Apart from short privilege leave vacancies, Mr. Knight, Professor of Agriculture, was on leave throughout the year and his post was filled first by Mr. P. C. Patil and then by Ráo Sáheb G. K. Kelkar. Mr. Main, Deputy Director of Agriculture, Northern Division, was absent on leave during the early part of the year, his post being filled by Ráo Sáheb G. K. Kelkar. Mr. Henderson, Deputy Director of Agriculture in Sind, was compelled to take sick leave in the latter part of the year, his post being filled by Mr. Gul Mahomed, and Mr. Gonehalli, Extra Deputy Director of Agriculture, Konkan, was transferred to the post of Assistant Registrar, Co-operative Societies, his post being filled by Mr. P. C. Patil.

4. In the Deccan the active propaganda of former years has been continued vigorously and a considerable move forward has been made in the Southern Marátha Country. The work in the Konkan is now getting under way but the

staff there is inadequate, and it will be difficult to do much there till we get an increase of staff. In Sind progress is being made, but the condition of the country does not lend itself to the achievement of rapid results. Gujarát, as usual, lags behind.

CHAPTER II.

SOME SPECIAL LINES OF WORK.

5. In the last report I endeavoured to estimate the progress that we were making in introducing new varieties of cotton in different tracts. Since the buying agency established at Surat by the Bombay Syndicate had broken down, as was explained, it was necessary to introduce some fresh organisation to enable the cultivators using seed of our improved strains to get the benefit which an insensitive market for seed cotton refused to them. We commenced on a small scale by getting the cultivators of a group of 7 villages to combine to grow our seed, gin their own cotton and market it jointly. A Committee was formed with a representative from each village and the Divisional Inspector of Agriculture as Chairman. The matter was carried through successfully, and the Committee sold the lint to Messrs. Narandás Rájárám and Co. at a premium of Rs. 12 per kandy over the price of local cotton. This represents the advantage in quality only. The advantage of ginning percentage was also obtained by the cultivators, since they ginned their own cotton. The net sum obtained by the cultivators amounted to Rs. 21,500 or an advance of 7½ per cent. on current local rates, 3/5th of which represented improved quality and 2/5th improved ginning percentage. The matter was carried through by Mr. Bhimbhái Morárji Desai to whom the credit for the organisation is due. That the purchasers were well satisfied is clear from the following letter :—

NARANDAS RAJARAM & Co.,
BOMBAY.

No. 111, Esplanade Road,
Fort, Bombay,
23rd September 1915.

My dear Bhimbhai,

You would be interested to know the report that I have got from Liverpool regarding the farm kapas cotton consigned by me to that market for sale. I transcribe hereunder the quotation in full :

"*Consignment 08.*—We have sold six bales B O T at 5·41 and reserved the remaining bale for type purpose. The price obtained was 15 points *over* the 'future' quotation, at the time, of 5·26 for August. Middling American was quoted that day at 5·39, so that we secured a small advance over your limit. The buyer was the mill that had tested a sample, so we presume the trial was satisfactory. We anticipate a nice business next season if you can get this quality in bulk."

I have already told you that the local mills to whom I forwarded the cotton are completely satisfied also and thus you may conclude that the outturn of this year's farm kapas crop has met with the approval of those for whose custom you may be catering.

Yours sincerely,
(Signed) PURSOTAMDAS THAKORDAS.

I think that this shows that our improved Surat cotton is a distinct advance on the local cotton and that we have produced a strain which the mills appreciate both in India and in England. Our operations this year were of course on a very small scale as against what we formerly attempted, but we must try to steadily extend them year by year, inducing groups of villages to organise to market their cotton grown from our seed jointly. It will not be an easy matter for the Department to organise on a large scale, but I can see no alternative.

6. In Sind American cotton continues to do well and is quite satisfactory both as regards yield and as regards quality. The difficulty, here also, was to

get the cotton valued and bought at a fair price. To meet this difficulty a Bombay Syndicate was formed to buy the seed cotton. The operations for three years may be summarised as follows:—

Year.	Upper Sind (estimates).	Lower Sind (actuals baled).
1913 ...	25 bales	500 bales.
1914 ...	100 bales	550 „
1915 ...	*Nil* (abandoned for want of a buying agency) ...	270 „

In Sind cultivation is so scattered and the country so undeveloped that it is not easy to make rapid progress. In Upper Sind also this difficulty occurred that the people were not accustomed to grow cotton at all, and it was a question of introducing cotton and not merely of changing the variety of cotton. Consequently the quantity received fell short of expectations. In Lower Sind, however, a fair start in production was made, but it received a check owing to the defective buying arrangements which did not suit the views of the cotton growers. In the first place the Syndicate were never ready to buy at the beginning of the season. American cotton begins to come in in September, but the Syndicate was never ready to buy till well into November, so that people who had brought in their cotton from a distance had to wait about indefinitely. Secondly, the system of deferred payments, and payments by drafts on Hyderabad were very unpopular. There were other minor points of complaint on the part of the cultivators and the result was that in 1914 half the cotton was sold not to the Syndicate but to Messrs. Ralli Brothers. In 1914 cotton prices were much disorganised by the war, but relatively the Sind-grown American cotton did very well, for with Sindhi cotton selling at Rs. 4 per maund American sold at Rs. 6 per maund at the beginning of the season and Rs. 7 at the end. In 1915, as a result of the fall in the price of cotton due to the war, a low inundation and the defects of the buying agency, the estimated outturn of American cotton is only 270 bales. The Bombay Syndicate have declared that the amount is too small to make it worth their while to buy and have finally closed down their buying agency. I understand that a Japanese firm is this year buying the American cotton. In Upper Sind the production of American cotton amounted to 100 bales in 1914, but as no buying agency materialised, it has been abandoned for the present. There is no reason to doubt, however, that extensive growing of American cotton in Upper Sind might have been nursed into existence with the help of a suitable buying agency. Another difficulty arose from the fact that roller gins were put up by the Syndicate instead of saw gins which are requisite for American cotton, and the value of the lint produced was considerably lessened. The present position is this that in Lower Sind we now have a large seed farm which grows excellent American cotton giving an all round average of 700 lbs. per acre, the lint of which is valued at Liverpool at 6*d.* per lb., the spot price for American middling at Liverpool on the same day being 5·89, that many cultivators are keen on growing American cotton, but that we must arrange for an effective buying agency before we can grow American cotton on a large scale. I am not yet prepared to say how we shall overcome this difficulty.

7. Our experience of creating buying agencies in Sind and Gujarát, if it has done nothing else, has given us experience as to what are the essentials of a buying agency suitable for nursing up an extended cultivation of superior cotton. They are roughly these:—

(*a*) There must be a responsible man on the spot with authority to act without constant reference to his principals at a distance.

(*b*) He must be able to value the cotton and pay for it on the spot.

(*c*) He must be ready to buy the cotton as soon as it comes on the market in the same way that local buyers do, and without any question of deferred payments or drafts on a distant treasury.

(*d*) The agency must be prepared to handle the cotton in the most effective way and to pay the full value, so that the maximum encouragement may be given to the cultivators; and if necessary, the agency must be prepared to drop money during the first few years until the area under the improved cotton expands to the extent necessary to place the business on a remunerative basis.

8. The introduction of N. R. cotton in Khándesh continues to progress. In view of the heavy fall in the price of Khándesh cotton which occurred last year, considerably less cotton was sown this year, and as a result of this we had more seed of N. R. cotton on our hands than we could dispose of, and the expansion did not proceed at the expected pace. This is, however, only a temporary check, and I expect that next year the expansion will continue normally. Our seed farm at Jalgaon is now organised, and we have 40 registered seed growers. Apart from this many cotton growers are now keeping their own seed. Fortunately this cotton requires no special buying agency, and it will doubtless continue to find favour not only in Khándesh and Násik, but in Ahmednagar and Sholápur also.

9. In the Southern Marátha Country Broach cotton has done badly during the last two seasons, which have been very wet in July and August, and shows a tendency to reduction in area. It is still restricted to the tract within easy reach of Dhárwár where we hold the auction, and there are many difficulties in the way of holding the auction at other places as well as at Dhárwár. Perhaps the greatest obstacle to the spread of Broach cotton, even in suitable localities, is that it must be sown early when the people are busy sowing their jowári. In some tracts Broach cotton seems to be established, and it will probably remain popular there, but I think that as regards the greater area we shall do well to concentrate our attention on putting out a strain of Kumpta with a good ginning percentage. We have several strains obtained from pure line breeding which show a marked advantage in this respect, and as soon as we are in a position to make a final selection of the best strain and to multiply its seed to an adequate extent I propose to concentrate efforts in the direction of putting it out on a large scale.

10. Perhaps the matter in which we have obtained the best results is in sugarcane growing. The Mánjri Farm is now admirably organised and its crops speak for themselves. We have obtained during the past year on very ordinary soil crops of 40 tons per acre and upwards of stripped cane of excellent quality, while at the same time effecting large economies of water and manure and in the cost of cultivation and seed, as compared with local practices. In testing the ripeness of cane, in crushing, boiling and gul making also we have many profitable improvements to show the cultivators. I am glad to be able to state that these improvements are spreading amongst the cane growers, who are taking up our methods of cultivation and planting. The requisite implements for cultivation and saccharometers find a ready sale, and men have been sent all over the Presidency to build improved furnaces and to give instruction in gul making. Numbers of cane growers visit the farm to receive instruction and to ask for information, and the last of the regular classes, lasting three weeks, which we periodically hold for cane-growers was attended by 50 persons. It was not till late in the year that we were able to organise a separate sugarcane branch for district work on the new canals, but before the end of the year Mr. G. N. Sahasrabuddhe had been able to help the people on the Godávari Canals with their gul making, and he has now got a number of demonstration plots which will serve as educative centres. The cultivators on the new canals need much help of this nature before they are in a position to grow sugarcane at a profit, and it will soon be necessary to extend these efforts to the Pravara Canals, and to the older canals in the Násik District. In view of the irrigation programme upon which Government has entered in the Deccan, I regard this work as of great importance; for the cultivators on the new canals have no experience of cane growing, and unless they are well advised are apt to suffer heavy initial losses from their inexperience. We must be prepared to expand this line of work as rapidly as possible.

11. The organisation of Deccan canals so as to admit of effective development is a matter which has received attention during the past year, and is a very important matter, since a profitable sugar industry cannot be built up without it. The matter has, however, been fully reported to Government. There has been some talk in recent years of the establishment of companies in the Deccan for undertaking gul making or sugar making on a factory basis; but so far nothing has resulted. It is much to be hoped that some such companies will take shape, for the educative influence of a well managed company on the present unorganised efforts of the cane growers would be great. Power crushers are becoming more appreciated. A new one has just been put down on the Mula-Mutha Canal for a group of 25 cultivators, and in the Nira Valley where the growers have been able to watch the working of the crushing plant which we erected six years ago, orders have now been received for several more.

CHAPTER III.

General Farming Matters.

12. There has been no striking departure during the past year in the matter of improved implements for cultivation but the work of popularising them has continued on an extended scale. Large sales still continue; but nowadays many cultivators go direct to the Bombay Agents for them, and buy them half a dozen at a time. We are now largely increasing the number of depôts at which implements can be bought or hired and spare parts obtained. There is a considerable demand for the hire of such implements by people who are not inclined at first to buy them. Many Agricultural Associations now keep implements on such terms, and many Co-operative Societies keep them for the use of members. Individuals too find it a profitable business to keep ploughs for hire, and there is at least one man who keeps over 100 English ploughs for this purpose. A workshop has been organised on the Dhárwár farm for the making and repair of farm implements, and is already doing good work. The same kind of work is done for the Konkan Division on the Alibág farm in a small way, and will be extended as funds permit. The implement business may thus be considered as a going concern, and it may be thought that there is little left for the Department to do in this way. This, however, is not the case; for as the number increases so does the work of instruction, adjustment, arranging for repairs, and provision of spare parts increase. In time, no doubt, this work will be unnecessary, and already in some parts the people are experienced in such matters; but there is still much necessary work in this line for the staff to do. Nor is such work without its reward; for the effect of the iron ploughs is now becoming well marked in many tracts in the improved cultivation that is visible.

13. An important matter which has received attention during the year is the question of cattle. A survey of the cattle in the Presidency has been completed and the report submitted to Government. The general conclusion arrived at was that it is with the stationary cultivator-breeder, rather than the wandering herdsmen and breeders, that the future of cattle breeding in this Presidency lies, and that it is to such men that help can be most profitably given. There are some noteworthy tracts where careful breeding is practised and fine animals produced, and it is from such centres that we must work. A start has been made during the past year in introducing the scheme for providing a reserve of good fodder against famine in the tracts where it is likely to be needed. The Kopergaon fodder farm is being got into shape, and part of it is now under fodder jowári. The Nadiad farm also has been converted into a fodder farm. In a few years we shall be in a position to estimate the cost of a fodder reserve so produced, and it is hoped that it will then be possible to extend the system. One of the best cattle breeding tracts is the Khillari breeding area comprising parts of the Sholápur and Sátára Districts and the adjoining Native States. Fortunately the Nira Right Bank Canal will come through the middle of this tract, and it should be possible at no very distant date to establish a good reserve of baled fodder for the good breeders, and do much to remove the constant menace of a fodder famine so far as the

valuable cattle are concerned. When we are able to offer them this security we shall be in a good position to effect improvements in breeding. Meantime something can be done, I believe, by introducing a system of putting out "premium" bulls, and proposals to this effect will be submitted as soon as funds permit. A good many persons are now interested in the making of ensilage and a number of cheap pit silos have been constructed. In localities where there is an abundance of grass during the monsoon the making of ensilage affords a good practical method of carrying over fodder to the hot weather at a small cost, and I believe that there is a good future for it.

14. The matter of dairying has also received attention and a Committee has sat to consider the best method of improving the milk supply of large towns. The report has recently been submitted and it is not necessary to refer to the matter in detail; but it may be mentioned that the general conclusion arrived at was that milch animals are kept under the most natural and economical conditions in the villages, and that the milk supply of the towns will be best secured by collecting milk in the villages in small lots and arranging for its effective transport in bulk to the towns. Suggestions for securing this object have been made in the report of the Committee.

15. The two primary essentials for the raising of crops are adequate soil and moisture. This sounds a self-evident proposition; but it may be as well to state it, since it is in these essentials that we are remarkably lacking in the Deccan. It is not for me to refer to the large irrigation works now in progress in the Deccan, and the question of well boring by this Department will be referred to later on, and is reported on in full by the Agricultural Engineer. The conservation of soil, however, is a matter which has received some attention in this Department during the past year. We have vast areas of uplands and sloping lands where the soil is so thin that it is only in exceptional circumstances that crops can be raised on it. In dry years the crops fail for want of moisture and in wet years the soil gets washed away. The past two seasons have been wet ones, and the effects of soil denudation have been very obvious. On the College farm on an area of light, sloping land the result of many years of good cultivation was swept away during a few exceptionally heavy falls of rain. The soil had been materially deepened and improved during the past eight years, but the heavy rain washed it away into the rivers, laying bare the rock in many places. In a season like the past one this goes on all over the country. A large part of the manure and the finer silt from the cultivated fields is well on its way to the Bay of Bengal before the end of July, and masses of good earth are banked up in the nalas and along the sides of the rivers. Under these conditions it is a doubtful speculation to take trouble in creating a good soil and tilth unless one is in a position to retain it. This accounts in great measure for the poor cultivation and neglected condition of so many of the lighter and sloping lands. The soil can be retained only by effective field embankments. Such embankments secure great advantages in a number of ways, and the fact is well appreciated by the people in some tracts. In places admirable embankments have been made to the great advantage of the cultivation, but for the most part the embankments are not effective or only partially so, and in many localities they are not attempted at all. The matter is not an easy one, and the problem varies very largely under a variety of circumstances. The question is being studied by Mr. S. S. Godbole, Assistant Professor of Physics, and a series of field embankments has been constructed on some light derelict land near the College farm with a view to convert it into good arable land and to obtain experience in this line of work. This departure was rendered possible by the gift of Rs. 5,000 made by Mr. Rájárám Báláji for agricultural experiments, and I know of no work which offers a larger scope for profitable development in the Deccan. In the Southern Division also Mr. Gilbert is working at the same problem, and I hope that we shall soon be in a position to offer competent advice, based on experience, to those in need of it, whose name is legion. Before substantial improvements of this nature can be effected, however, it will be necessary to offer more than advice. When the physical problems have been solved there will still remain the difficulty due to the presence of many separate holdings on a single slope, which must be treated as a whole if any effective system of

fields embankment is to be constructed. With organisation, however, I believe that much can be done, and it will be our endeavour to push on this line of work as fast as possible.

16. In the matter of artificial manures the results of our past experience have been recorded in a bulletin by Dr. Mann which affords interesting reading. At the present time when the price of all artificials is greatly enhanced owing to the war, the matter is not of immediate practical importance, but viewed from the standpoint of normal prices is of considerable interest. Briefly it may be noted that it is only for the more valuable garden crops that it has been clearly demonstrated that artificials can be used profitably. Such crops are sugarcane, potatoes, onions and plantains, and with them an undoubted additional profit can be secured by this means. Speaking generally, it is only when the water supply is under control, in other words when irrigation is available, that their use can be recommended; but in tracts where the rainfall is most regular there may be a future for them even in the case of unirrigated crops. The problem of manuring rice in the Konkan has not progressed far. Green manuring is very difficult to accomplish under our climatic conditions, and it is difficult to obtain a profit by the use of artificials on rice. The results obtained, however, are instructive, and in a few years time this work should enable us to form some useful conclusions on the subject. The manufacture of poudrette now takes place in towns where formerly this valuable source of manure was completely wasted, and its use is certainly on the increase. It is a striking sign of the times that a high caste cultivator should be ready to prepare and use his own poudrette, and an instance of this has recently come to light.

CHAPTER IV.

Agricultural Education.

17. The Agricultural College continues to progress, and the number of students is now greater than ever before, amounting to 124. This is mainly due to the continued increase in the number of short-course students who attend the college. This development was, perhaps, not originally contemplated, but is certainly desirable. There is a good demand for this course, and the result cannot fail to be beneficial. I consider that the college is doing well in all respects, and have nothing but praise for Dr. Mann and his staff.

18. As regards the Agricultural schools, the Loni School has had a successful year and has been improved in equipment. It now has 43 students of the right class, and I think that it may be regarded as an established success. The average annual cost for each boy is about Rs. 180, half for maintenance and half for education. The boys who have passed through the school are for the most part doing good work on their own lands. The Devi Hosur School completed its first year with 14 students, and since then 10 more have joined. It has made a good start and is getting into shape. In Mr. K. M. Pawar and Mr. R. Y. Hulkoti we have two capable Head Masters, and they have taken up the work with energy. These Agricultural schools certainly commend themselves to the public, but there is less disposition on the part of parents to send their children to such schools than might have been expected in view of the advantages that are offered free of cost. This is, no doubt, due to the fact that people of the class concerned are not accustomed to send their sons to a distance from home for educational purposes. This applies particularly to the case of small boys, and it is possible that we may find it desirable to raise the age for the admission of students at the Devi Hosur School. The sentiment on the subject varies in different localities and we must adapt ourselves to it.

19. In Sind the Agricultural school was attended by 10 students which is the limit of its capacity. It is doing useful work and draws students, and it is proposed to increase its accommodation for students so as to meet the demand.

20. Two new schools are projected—one for Chopda (East Khándesh) and one for Jámbul (Thána). A Head Master has been trained for the Chopda School and it is hoped that the school will start operations in June next as a

non-boarding institution in a building and on land provided by the people of Chorda. A Head Master is in training for Jámbul and plans and estimates have been prepared for the construction of the school buildings. The school will be opened as soon as the buildings are constructed. In this case the cost of the buildings will be defrayed by contribution from the Sir Sassoon David Trust Fund, and the farm land is provided by Mr. Vithoba Khanduji Pisál who is also endowing the school with land which will bring in about Rs. 1,000 a year towards its revenues.

CHAPTER V.

Agricultural Engineering.

21. The erection of pumping plants continues, and year by year more water is used which formerly went to waste or was lifted by a less economical means. The Agricultural Engineer has made a distinct advance in designing improvements which will obviate foundation and belt troubles for small pumping plants, and every such improvement which reduces the chances of a breakdown will serve to encourage cultivators to adopt this profitable but unfamiliar means of raising water. The advice and assistance which he is giving prevent many a man from purchasing unsuitable machinery. There are now several large pumping plants erected by the owners with the intention of selling the water to surrounding cultivators. This brings the owners up against the problem which faces the projectors of any large agricultural enterprise in this Presidency, namely that the land is much divided amongst a number of small holders, many of whom are unable or unwilling to make any new departure, even though the prospect of profit is good. I have seen cases in Gujarát where this difficulty has been overcome by the owner of the pumping plant hiring the land around or making successful arrangements to sell the water to neighbours, but it must be confessed that the cases of large pumping plants like those of Kasandra (Ahmedabad), Nándgaon (Poona) and Bhambora (Ahmednagar) present serious difficulties in this respect. If lifting water is to pay, the water must be used skilfully. A man who has the enterprise to erect pumping plants generally has the will and intelligence to arrange for the effective use of the water, but it does not at all follow that his neighbours have. This is a point that any man who erects a large pumping plant, expecting to sell a large part of the water to his neighbours, should carefully ascertain before he undertakes the enterprise.

22. Well boring continued successfully in Gujarát, and I anticipate that our past operations in Upper Gujarát will show a marked effect in the figures of land irrigated during the present year of short rainfall. The extension of the work to the Deccan and Southern Marátha Country has given some useful results. The boring of wells in Deccan trap yields a good proportion of successes though the supply of water is not usually very large, and in the sandstone and limestone formations in the south of the Presidency the indications are hopeful though the work has presented considerable difficulties due mainly to the presence of quartzite. There appears to be a good future for the use of such borings in the Deccan to procure a domestic water supply by sinking a pipe from the surface and attaching a pump without digging a well at all. Such supplies have the great advantage that they are safe from contamination as compared with the ordinary draw well. Examples of such borings, with hand pumps and with power pumps fixed, can now be seen working in Poona. Nor are they expensive, as the case of the boring for the Anand Veterinary Dispensary showed. In this case the boring, pump and fittings cost only half the money estimated for an ordinary draw well.

23. In the matter of steam ploughing we made a step forward by the purchase of a second ploughing plant for Gujarát. This got to work during the year and more than covered its running cost, including interest and depreciation, with a charge of Rs. 12 per acre for ploughing. The Ranebennur plant, for reasons detailed by the Agricultural Engineer, worked at a loss of Rs. 4,277 during the season; and we have now put up the charge per acre from Rs. 21 to 25. The work which we are asking these ploughing plants to do is

of a much more difficult nature than the ordinary operation performed by such plants in Europe. At Ranebennur deep ploughing is required in a very heavy soil, and at Dakor comparatively shallow ploughing on a land formerly uncultivated and full of deep holes. At Ranebennur some of the difficulties are permanent and some were temporary. Amongst the former may be mentioned the high price of coal, the long haulage of water and the very short season suitable for the work. The object of the work is to eradicate deep-rooted weeds, and this can be done only when the ground is dry and there is no fear of rain. The only safe season at Ranebennur is from the middle of December to the middle of April, a period of four months. Further north in the Deccan and in Gujarát we can get a season of at least six months.

24. The completion of the workshop at the College farm will greatly facilitate the work of the Agricultural Engineer and enable him to extend the good work which he is already doing of training men to handle agricultural machinery, effecting repairs both for the Department and the public, and adapting to our special requirements mechanical appliances that we are now using.

CHAPTER VI.

Propaganda.

25. The following publications have been issued since those mentioned in last year's report:—

Bulletins.

No. 68.—A note on well boring.

No. 69.—Rice stem-borer in the Konkan.

No. 70.—Improvement of cotton in the Bombay Presidency.

No. 71.—Grape growing in the Násik District.

No. 72.—Experiments with the Automatic Water Finder.

No. 73.—List of plants, seeds and bulbs available for distribution in the Ganeshkhind Garden.

No. 74.—Well waters from the trap area of Western India.

No. 75.—Notes on the cattle of the Bombay Presidency.

No. 76.—Artificial manures, experiments on their value for crops in Western India.

Leaflets (with Vernacular versions).

No. 6 of 1914.—Pachat (trash) as manure for sugarcane.

No. 7 of 1914.—Cultivation of chillies.

No. 8 of 1914.—Earthing up of sugarcane with the sabul plough.

No. 9 of 1914.—Improved furnaces for gul-boiling.

No. 1 of 1915.—The north-west locust.

No. 2 of 1915.—Cultivation of onions.

No. 3 of 1915.—Cultivation of bananas.

No. 4 of 1915.—Polishing of turmeric for the market.

No. 5 of 1915.—The Meston plough for the Konkan.

No. 6 of 1915.—The preservation of seed.

No. 7 of 1915.—Crops cultivated on *bandhs*.

No. 8 of 1915.—The proper planting of cane sets.

Leaflets for Sind only.

(1) Storage of seed potatoes at Lándhi Government Farm.

(2) New implements useful for Sind.

The total number of leaflets issued to date is 68.

26. Owing to the disturbance caused by the outbreak of war and the fall in the price of cotton, and in several cases owing to the outbreak of plague a number of projected agricultural shows were abandoned. Four large agricultural shows, however, were held and a large number of demonstrations. The district staff put in a good year's work, establishing new implement depôts, popularising implements, distributing seed, inducing cultivators to steep jowári seed in copper sulphate solution, introducing the use of silos, and helping cultivators to adopt methods of cultivation with which they were unfamiliar. I am glad to be able to note a distinct increase in activity amongst the district staff in the Southern Division; but in Gujarát they have not shown much capacity for impressing the cultivators or introducing improvements, though there have been some signs of progress during the past year.

27. Five new Agricultural Associations came into existence and three became defunct. Some of the Associations are doing valuable work, notably the Táluka Associations in Khándesh which maintain demonstration plots and organise demonstration meetings. In Kánara the Honáwar and Kumta Associations continue their useful activities through the agency of a few energetic gentlemen, and the Páthardi Mahál Association undertook a good programme of work and organised a number of cultivators' meetings. With Co-operative Societies also our connection has extended in a number of ways and with good results. A cattle breeding society has made a good start, and several dairy societies show distinct promise.

CHAPTER VII.

General.

28. There are many matters to which I have not referred in this report, not because they are of less importance, but because a full account is given of them in the detailed Appendices. The question of fruit culture, however, demands mention. There are few matters in which more requests for advice and assistance are received than in the matter of fruit culture. When a man digs a new well one of the first things that he usually does is to plant a few fruit trees, and he frequently makes mistakes due to inexperience. Finding the result unsatisfactory he then asks for advice. Though the area under fruit is relatively small in most localities the matter is thus of considerable importance. It is at the Ganeshkhind Garden that the study of fruit culture takes place, and the work done there in the past is now showing good results. The plantations of grapes, citrons, figs are in excellent condition, and fruit growers take the advice offered by the garden staff with confidence. The members of the garden staff have severally specialised in the culture of different fruits and have done much to spread amongst the public the information gained. If we are to get in touch with any considerable number of fruit growers, however, we must have other centres to work from: Gardens have accordingly been organised on the Dhárwár, Gokák, Dhulia, and Dohad Farms, and members of the staff have been sent to the Ganeshkhind Garden for short courses of training in horticulture. This development is already leading to useful results and will be steadily continued. The spraying of grapes against mildew has now become a regular operation on the part of the best grape growers at Násik, and the people of Kánara are taking to the spraying of betelnuts as a protection from *koleroga*, and in some places are undertaking for themselves the operation which we have been conducting for them for several years past. The study of grasses also has advanced considerably, and the garden staff are now in a position to advise on the renovation of poor pastures. I think that in some localities there is a future for such work, though we still have to prove its practicability.

29. Much progress has been made in getting cultivators to steep jowári seed in a copper sulphate solution as a preventive against smut. Packets of copper sulphate costing one anna apiece and sufficient to steep the seed for four acres are now available. In the Southern Division alone 25,000 such packets were sold, 7,000 in the Háveri Táluka, and in the Northern Division about 10,000 packets. This Presidency grows 7,295,000 acres of jowári and the

losses from smut are very heavy. Taking the very moderate estimate of an average of Rs. 2 per acre, the total would work out at a loss of nearly Rs. 1½ crores annually. If the packets sold last year were all used properly they must have saved some Rs. 3 lákhs for the cultivators. I believe that most of them have been properly used, and many cultivators to whom I have spoken are quite agreed as to the gain from using them. A large cultivator from the Hubli Táluka, however, who grows 50 acres of jowári complained that the steeping had done little to reduce the smut. It turned out that, being economical, he had used only one packet to steep the seed for 50 acres, instead of 13. He had thus saved 12 annas and lost Rs. 150 on his own computation. Every effort will be made to popularise this steeping, and the revenue authorities in some localities are assisting us greatly in the matter.

30. In conclusion I would select from many capable workers the following for special mention:—

Ráo Sáheb G. K. Kelkar has done very good work in the posts of Deputy Director of Agriculture, Northern Division, and Professor of Agriculture, and has found time to record in some useful bulletins the result of his observations and long experience in this Department. Mr. P. C. Patil as Professor of Agriculture, Extra Deputy Director in the Konkan and Deputy Director of Agriculture, Northern Division, has shown that he possesses good organising powers and resource, in addition to the sound knowledge of agricultural theory and practice of which he had formerly given evidence. Amongst the more junior members I may mention Mr. G. R. Mahájan who has brought the Mánjri Farm to a high state of excellence and shown his capacity as a first class cane grower and a demonstrator of his methods, and Mr. G. L. Kottur who is doing good and careful work on cotton selection in the Southern Division.

I have the honour to be,

Sir,

Your most obedient servant,

G. F. KEATINGE,

Director of Agriculture.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

APPENDIX A.

REPORT OF THE AGRICULTURAL COLLEGE FOR THE YEAR 1914-15.

College Buildings.

2. The year under report is the seventh since the establishment of the College as a separate institution. It has had, for the first time, the use of the whole of the new buildings, including the College hostel, during the year. Even the long delayed sanitary scheme was completed and in use before the close of the year.

University Agricultural Course.

3. The University Agricultural course, to which the main energy of the College is devoted, has been subjected to much criticism from the old students, from some members of the staff, and finally from Sir Alfred Hopkinson who visited the College on behalf of the Bombay University in November 1913. As a result of these criticisms, particularly of those by Sir Alfred Hopkinson, the University Syndicate appointed a committee to make recommendations with regard to the future of the courses, consisting of the Principal of the College, Mr. G. F. Keatinge, Dr. W. Burns, and Ráo Sáheb G. K. Kelkar. The committee has recently reported, and their report is now before the University.

Short Course.

4. The short course, started six years ago, as an addition to the College work, is intended for farmers' and landowners' sons. For this the sole qualifications are that the student should know English and have a fairly good general education. The training given is essentially a practical one, and is designed to give as good an acquaintance as possible with the best methods of agriculture applicable to our areas. There was at first some doubt as to whether there was a real demand for this course, but this is now entirely dissipated, and the number of the suitable students tends to increase and the quality of the students as well as their number is higher now than in any previous year. The actual number of students attending the course has been as follows:—

1909-10	4
1910-11	12
1911-12	13
1912-13	15
1913-14	15
1914-15	22
1915-16	27

College Staff.

5. The Principal of the College was on privilege leave during a part of February and March 1915, when Dr. Burns officiated for him, and Dr. Burns was on leave from April 18th to May 23rd, 1915, when Mr. H. M. Chibber again acted for him as Professor of Botany. During the absence on two years' leave of Mr. J. B. Knight, the permanent Professor of Agriculture, his place was taken until September 1914 by Mr. P. C. Patil, L.Ag., one of the most brilliant graduates from the College, and by Ráo Sáheb G. K. Kelkar during the remainder of the year.

There has been no other change in the staff of the College during the year under report.

Students.

6. The number of students this year is slightly higher than in 1914, but the increase has been chiefly among the students of the short course. The actual figures for the past seven years have been as follows:—

	909.	1910.	1911.	1912.	1913.	1914.	1915 July.
First year students ...	38	36	38	38	43	36	35
Second year students ...	26	33	24	27	25	31	29
Third year students ...	39	27	28	22	26	27	31
Short course students...	4	12	13	15	15	22	27
Special and Post-graduate students ...	1	2	1	2	1	1	2
Total ...	108	110	104	104	110	117	124

The students during the last five years included in the above table have come from the following parts of India :—

	1911.	1912.	1913.	1914.	1915.
Bombay Presidency... Deccan ...	28	2	28	23	20
Bombay Presidency... Southern Maratha Country and Konkan ...	34	25	29	38	45
Bombay Presidency... Gujarát ...	23	25	27	23	35
Bombay Presidency... Sind	4	6	4	8	7
Eastern Bengal and Assam	2	...	...	...	1
Central Provinces	1	...	1	...	...
Bengal	1	...	...	...	...
Central India	...	3	3	3	3
Nizám's Dominions	2	2	5	7	3
South India and Ceylon	9	14	11	12	7
Burma	...	1	1	...	1
United Provinces	...	...	1	2	2
Berar	...	...	...	1	...

Arranged according to the castes or classes from which they come, the students stand as follows:—

	1911.	1912.	1913.	1914.	1915.
Bráhmins	54	45	45	43	55
Maráthás	8	4	5	5	5
Lingáyats	5	2	5	4	4
Patidars (Gujarát)	4	3	2	2	3
Mahomedans	4	10	10	7	12
Pársis	4	9	9	13	15
European and Anglo-Indian	..	1	1	1	1
Others	25	30.	33	32	29

7. These students may be divided into three classes :—

(*a*) By far the larger number are qualified to study for, and intend to take, the agricultural degree of the Bombay University. The qualification on which the Bombay University insists, namely, the Previous Examination or its equivalent, is insisted on in the case of practically all students from the Bombay Presidency itself, and no student can, of course, appear for the University Agricultural Degree without it.

(*b*) The second class consists of a few students who are not admissible to the University Examination, but who are taking the regular course along with the first class of students. These exceptions arose from the fact that it has been decided by Government to allow scholars to be received from Sind who have only passed the Matriculation Examination, provided that they were to receive the same course, and pass by the same standard as the University demands. Under this ruling, students have been received every year since 1908. At the same time some applications were received from other Governments in India and Ceylon to be allowed to send students and from private persons outside the Presidency for admission to the College, where the applicants were not fully qualified for the University course. Where there was evidence to show that such students could properly follow the course a small number have been admitted as follows :—

	Admitted in 1911.	Admitted in 1912.	Admitted in 1913.	Admitted in 1914.	Admitted in 1915.
Nizám's Dominions	...	...	...	1	...
Sind	1	2	1	2	1
Bombay Presidency and Native States subordinate to it	3	...	...	2	2
Ceylon	...	5	...	...	...
Goa	1	...	...	...	...
United Provinces	...	...	1	1	...
Central India Stat s	...	...	...	1	...

(*c*) In the third place we have the short course students already referred to. The places from which they come are as follows:—

Deccan	5
Southern Marátha Country and Konkan ...	4
Gujarát	9
Nizám's Dominions	3
South India and Ceylon	4
Central India	1
Sind	1

As has already been stated, this course is not a qualification for Government service in British India, and the large majority of those who take it do so with the intention of putting their training to advantage in actual farming.

8. In addition to these classes, we are being occasionally requested to undertake the training of men for special purposes. For the last two years we have had a young man with us in training for botanical work under the Department of Agriculture, Burma. We have had during the year a man under training for special botanical work under the Department of Agriculture, Travancore. We have also now two men who are working at the Chemistry of Foods in the laboratory of the Agricultural Chemist.

University and other Examinations.

9. At the University Agricultural Examinations held in 1915 the number of candidates shown in the following list were presented with results as indicated :—

	Sent up.	Passed.	Failed.	Percentage of passes.
First Examination in Agriculture	28	24	4	85·7
Second Examination in Agriculture	29	28	1	96·6
Bachelor of Agriculture Examination	21	20	1	95·2

A special College Examination of the students (referred to above) not entitled to take the University Examination, was held in March 1915 with the following results :—

	Presented.	Passed.	Failed.
First Examination in Agriculture	7	5	2
Second Examination in Agriculture	2	1	1
Final Examination for Diploma in Agriculture	6	5	1

10. The number of students who passed through the regular course at the College and succeeded in obtaining the University Degree or the College Diploma (which is of the same standard and represents the same character of man) is as follows during the past six years :—

Year.	Degree.		College Diploma.		Total.	
	Entered.	Passed.	Entered.	Passed.	Entered.	Passed.
1909	34	26	...	...	34	26
1910	39	36	...	...	39	36
1911	22	20	5	5	27	25
1912	27	22	1	1	28	23
1913	19	14	4	3	23	17
1914	23	18	3	3	26	21
1915	21	20	6	5	27	25

I think it may be taken that in future the number who appear in the final agricultural examination will be about twenty-five to thirty each year, and the number of graduates about twenty-five.

Scholarships.

11. The number of scholarships offered by Government at this College is now fifteen per annum. Candidates must have passed the Previous Examination of the Bombay University or obtain the certificate from the Principal of an Arts College, which the Bombay University now accepts instead of that examination, and are selected by the Director of Agriculture in consultation with the Principal of the College. They are given by preference to the sons of cultivators and are awarded for the three years occupied by the course. The Director of Agriculture is empowered to extend the tenure of the scholarships to four years, and give a limited number to Matriculates, who afterwards will join this College, for study in an Arts College. During the last six years scholarships have been awarded to candidates from the various districts as follows:—

	1910.	1911.	1912.	1913.	1914.	1915.
Deccan	2	5	6	2	2	...
Southern Marátha Country ...	3	3	2	3	4	5
Gujarát	3	6	...	2	4	2
Konkan	2	1	...	1	5	6

12. The students from Sind are on a different basis. They are appointed by the Commissioner in Sind, and are not required to have passed the Previous Examination in every case. We have now at the College one such scholar from Sind in the first year, three in the second year and one in the third year.

13. Other Governments and the public bodies have utilised the College for the training of scholars. The number so admitted since 1910 has been as follows:—

Date of Entry.

	1910.	1911.	1912.	191	1914.	1915.
Baroda Government ...	...	...	2	...	...	1
Sangli State	1	...	...	1	...	...
Aundh State	...	...	...	...	...	1
Jamkhindi State	...	...	1	1	...	...
Porbandar State	...	1	...	...	...	...
Kotah State	...	1	...	...	...	...
Vithalgadh State	...	1	...	...	...	...
Jámnagar State	...	1	...	...	...	...
Lingáyat Education Fund ...	1	...	...	2	...	...
Ceylon Government... ...	...	...	4	...	...	...
Bánsda State	...	...	1	...	...	...
Rájpipla State	...	...	...	2	...	...
Junágadh State	...	...	...	1	...	...
Dewás State	...	...	...	...	1	...
Indore State	...	...	...	...	1	...
Mysore	...	...	...	...	1	...

Library.

14. The growth of the College library is very satisfactory. Eight years ago it did not exist. On the separation from the College of Science being completed, a number of books (chiefly old and out of date) on Agriculture, Botany and Veterinary Science were handed over to us and formed a nucleus for the future. A special grant of Rs. 6,000 per annum was made in 1900 for library purposes, and was continued during the two following years. Since that time the annual grant has been Rs. 2,500. With the funds thus made available and a number of presentations of books, the library has rapidly increased. The number of books in it at the end of the last seven years has been as follows:—

1908-09	1,182
1909-10	2,780
1910-11	4,000
1911-12	5,040
1912-13	5,943
1913-14	6,840
1914-15	7,638

I wish specially to express my thanks to Dr. N. A. F. Moos of Bombay who presented during the year an almost complete set of the Journal of the Highland and Agricultural Society to the College library.

It is fairly consulted, not only by College students, but by gentlemen from all parts of the Presidency, and every effort is made to make it increasingly useful to the public.

College Quarters.

15. The College quarters have been completed during the past year including the sanitary arrangements. The quarters seem very satisfactory on the whole, and are much appreciated by the students. The Superintendent, Mr. D. L. Sahasrabuddhe, B.Sc., L.Ag., has managed the hostel excellently and with great tact. The fact that such a large proportion of our students are resident, 118 out of a total of 124 students, makes the College hostel a real centre of College life.

Employment of Graduates.

16. The demand for agricultural graduates is increasing, and there seems now little trouble in placing the good men. As I write I have several applications in hand for men, to fill which I have difficulty in finding satisfactory candidates. Of the past students of the regular three years' course who have been employed or arranged for during the year, the direction of activity is as follows:—

Bombay Agricultural Department	5
Bombay Executive Government Service	3
Baroda Agricultural Department	2
Private employer	1
Employed on their own land or in connection with industries, depending on agriculture	3

College Dairy.

17. During the year the Government Civil Dairy at Kirkee has been under the control of the College and the Manager of the Dairy is Assistant Professor of Dairying. This has been used for several years as a teaching centre for dairying for the students, and in future it will be available in greater measure than hitherto, as this is now recognised as one of its primary functions.

Veterinary Dispensary.

18. The District Veterinary Dispensary at Bhamburda has been carried on as a College Dispensary during the year. Charge of the Dispensary was in the hands of Mr. F. Gracias, G.B.V.C., assisted by Mr. B. B. Joshi, G.B.V.C., as Resident Veterinary Officer. During the year there has been a distinct increase in the number of patients. A total of 1,458 animals were treated (as against 1,059 in the previous year), of which 409 were in-patients and 1,049 as out-patients. The daily average attendance of in-patients was 15·2 and of out-patients 16·6. Of these treated 712 were agricultural animals. Out of the 1,458 cases, 699 were treated free. Among contagious diseases, there were twenty-three cases of suspected rabies in dogs and one in a bullock, of which ten dogs and one bullock proved to be rabid. A large number of cases of foot and mouth disease were treated in connection with an outbreak at Ganeshkhind, Kirkee and at Manjri. One cow was treated for rinderpest and extensive inoculation undertaken on the College and Dairy farms. An outbreak of hæmorrhagic septicæmia occurred near Manjri. Three animals were treated but all died. Animals were also treated for piroplasmosis. All these cases were reported at once to the Superintendent of the Civil Veterinary Department. The Superintendent, Civil Veterinary Department, inspected the dispensary on July 13th, 1915.

Other Matters.

19. During the year under report, the College undertook the responsibility for the fifth time of giving the short three weeks' course in agriculture which all the junior members of the Indian and Provincial Civil Service have to take. It was attended by nine members during the present year, and the teaching was undertaken by Professors Burns, Kelkar and myself, while the Agricultural Engineer to Government also assisted. The future of this course is now under the consideration of Government.

20. A course in Arboriculture for Subordinates of the Public Works Department was undertaken for the first time in February 1915. The organisation of the course was entirely in the hands of Dr. W. Burns and the instruction was actually given by Mr. H. P. Paranjpye, B.A., Assistant Economic Botanist. The success of the course was entirely due to the enthusiastic work of these officers.

21. For two years in succession now large numbers of plague rats have died during November on the College farm. In 1913 actual cases occurred among the farm servants; in

1914 there were no such cases, however, but as rats died in the College hostel it was deemed advisable to make other residential arrangements for students for a time. I devoutly hope that no similar attack will occur again.

22. The staff have worked well, and are doing a considerable amount of research, and also of demonstration work in addition to their own duties. I may repeat what I said last year that the College tends to become every year more and more of a centre for activity in connection with agricultural improvement and the dissemination of agricultural information. It has hence been visited by a constantly increasing number of landlords and other interested gentlemen on the one hand, and on the other by large crowds of cultivators. For nearly two months in September and October 1914 large parties were brought almost daily to the College farm under arrangements suggested by the Commissioner of the Central Division. Every effort is made to stimulate the public interest, as it is felt that the permanent success of the institution must largely depend on the extent to which it can be maintained.

HAROLD H. MANN,
Principal.

APPENDIX B.

REPORT OF THE MARATHI AGRICULTURAL SCHOOL, LONI, POONA, FOR 1914-15.

The Marathi agricultural school at Loni has now passed beyond the stage of experiment. It will be remembered that it was established in Poona in 1910 as an agricultural boarding school, the object of which was to give a thoroughly practical training to boys, who belonged to good substantial cultivating and landowning families, whose object in life was to cultivate or manage their own lands. The course is one of two years for boys by preference between the ages of 14 and 16, who have at least passed the fourth Maráthi standard. It is under the supervision of the Principal of the Agricultural College, but is quite independent of the College, with an experienced agricultural graduate as headmaster.

2. The school was removed to Loni, to land and buildings specially prepared for it, in November 1913, and has been carried on these since that time. In laying out the school at Loni, an attempt was made to make the whole property as much like a substantial cultivator's holding as possible. The area is twenty-nine acres and is practically entirely worked by the boys. It contains land suitable for cultivation with and without irrigation, and a small fruit plantation is being laid out. A portion is irrigated by means of a small oil engine, which every boy has to learn to drive himself. The school and residential buildings are laid out like a large village *wada*, and the whole place is really a self-contained agricultural centre.

3. The boys at present in the school number forty-three, derived from the Maráthi speaking districts as follows:—

	1st year.	2nd year.
Poona	2	2
Sátára	...	1
Sholápur	...	1
Ahmednagar	1	1
Násik	8	5
East Khándesh	3	...
West Khándesh	1	...
Ratnágiri	3	1
Belgaum	1	...
Kolhápur State	1	1
Ichalkaranji State	1	...
Sángli State	...	2
Janjira State	...	1
Aundh State	...	3
Jamkhindi State	...	2
Akalkot State	...	1
Berar	1	...

4. Arranged according to caste the boys stand as follows:—

	1st year.	2nd year.
Maráthas	9	10
Mális	1	...
Gujarátis	2	...
Bráhmins	10	11

Those admitted are carefully selected from a much larger list, and only those who are genuine cultivators or landowners who intend to work their land are as far as possible admitted.

5. Mr. K. M. Pawar, B.Ag., has been headmaster during the greater part of the year: he went on privilege leave, however, in April 1915 owing to a breakdown in health. During his absence his place was taken by Mr. J. G. Naik, B.Ag., who was trained in the school for this class of work. Mr. Pawar has now returned and is showing his accustomed energy. During the year Mr. G. G. Pundlik has been taken for training with a view to utilising him later at another agricultural school.

6. The school has been supported by a number of district local boards, and during the five years the school has been in existence the following subsidies have been received :—

	1910-11.	1911-12.	1912-13.	1913-14.	1914 15.
	Rs.	Rs.	Rs.	Rs.	Rs.
East Khándesh	200	200	72	...	72
Poona	225	...	720	...	...
Násik	250	250	216	288	...
Ratnágiri	250	...	216	...	...
Sátára	...	116	432	504	288
Sholápur	...	50	420	504	288
Ahmednagar	...	100	...	840	72
Thána	...	...	72	144	72
Bijápur	...	...	72	...	...
Kolába	..	...	72	...	...
Belgaum	...	...	...	72	144

The trustees of the Sir Sassoon David Trust have for the third time made a grant of Rs. 750 to the school, being the whole cost of the training of five boys. Our thanks are due to the generous donors of these amounts.

7. The curriculum has been very slightly modified during the year, but on the whole has been quite successful. It involves, as I explained in last year's report, at least half the working time being spent in farm work, or in gardening, in dairying, or in other agricultural operations. The boys do practically all the work on the land allotted to their use, and they have almost entirely produced the food, and fodder, except the grain and pulse, used in the school. The school work more properly so-called consists of arithmetic, more especially including farm accounts on the one hand, and mensuration applied to agricultural purposes on the other; nature study largely taught practically; writing and reading; geography of India especially in relation to crops; the principles of agriculture; and two new subjects (1) 'village life' including sanitation, hygiene, and secondary occupations suitable for villages; and (2) what we call 'citizenship', which includes question of how to obtain money by *takavi*, by co-operative credit, or by other methods, and in addition, the system of local and village Government in this part of India.

8. The number of applications for admission to the school has been considerably greater than we can take, but a careful selection was made, and admission is only granted to those who are themselves cultivators, or who are small landowners where the boys are intended to devote their life to work in connection with land. The course is moreover a hard and practical one, and unless a boy is ready to work on the land at what some consider menial occupations he does not want to stop, and so there is considerable leakage at first. It is, I feel, nevertheless, essential to maintain this tone if the school is to serve the purpose for which it is intended.

9. The school has been frequently visited by ruling Chiefs, by officers of Government, and by many of the parents and friends of the boys. A good metalled road to the school is now complete, and a visit will be easier in the future than it has been in the past, at any rate during the rains. The Chief of Aundh was kind enough to offer two prizes, a Kirloskar iron plough and a hand hoe, for competition among the boys and this aroused considerable enthusiasm.

10. At the end of the school year in April 1915, the boys were examined by Messrs. V. G. Gokhale of the Agricultural College Farm and S. L. Ajrekar of the Poona Agricultural College, and as a result fifteen certificates were granted to boys who had completed their two years' training. The examiners made remarks as follows :—

"The results, in general, of the annual examinations show that the school has maintained the high standard which it has established for itself in previous years.

"The boys have done extremely well in the subjects of arithmetic, sanitation, Maráthi language, and surveying, as is the case every year.

"In the major subject of agriculture, however, they have not done equally well. The papers and oral examinations in this subject showed that the boys have more a tendency for learning the bare facts taught to them by rote than to reason and attempt to think how they can be applied in their own agricultural practices. Only a few boys seemed to know the conditions of agriculture in their own homes and many hardly showed any signs of having thought definitely which part of the knowledge gained in the school they can turn to their own use.

"We, therefore, recommend that the boys be asked to collect and record, in each vacation, information on definite questions to be set by the school about their own farm and the agriculture of their own village and that of their neighbourhood. One or wo hours a week might be devoted to train up the boys on the basis of such information, to develop their power of discrimination, judgment, and application of the varied knowledge they get to the given definite conditions.

"In sanitation and nature study, both the classes did very well, though there was some indication of learning by rote. The essay writing showed powers of expression and arrangement of thought which would be creditable even in students more specifically engaged in literary studies. The performance of the classes at the reading was also good."

11. Sixty boys have now completed the course and been granted certificates. Most of these are farming on their own or on other land. We are keeping as far as possible in touch with them, and it is hoped they will become centres of influence in the future. We held a reunion of old students before the vacation in April. A considerable number came and recounted their experiences which were on the whole of a very encouraging character. The school is increasing too in local influence, and is now established as an implement depôt under the Agricultural Department.

12. The accounts of the school are shown in the following statement :—

Receipts.	Rs.	a.	p.	Expenses.	Rs.	a.	p.
1. Balance for 1913-14 ...	1,854	4	8	1. Establishment ...	1,939	5	3
2. Poona Treasury (Government grant).	7,720	0	9	2. Boarding charges ...	3,112	14	3
3. Local Board Grants ...	936	0	0	3. Purchase of live stock	215	0	0
4. Grant from Sir Sassoon David Trust Fund.	750	0	0	4. Cultivation charges, purchase of carts, etc.	710	2	2
5. Sale-proceeds, etc. ...	207	7	6	5. Feeding of stock ...	475	1	3
6. Hire of ploughs ...	33	15	0	6. Draining, levelling and making garden.	201	11	9
				7. Conservancy charges ...	160	0	0
				8. School furniture and books.	20	4	3
				9. Postage charges ...	40	0	0
				10. Travelling allowance and tours.	324	8	0
				11. Road construction ...	1,237	2	0
				12. Construction of workshop and fitting.	1,235	0	0
				13. Irrigation charges ...	81	6	0
				14. Remitted to the Treasury.	1,033	6	6
				15. Miscellaneous office expenses.	715	14	6
Total ...	11,501	11	11	Total ...	11,501	11	11

HAROLD H. MANN,
Principal, Poona Agricultural College.

APPENDIX C.

SUMMARY OF THE WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, NORTHERN DIVISION, POONA, DURING 1914-15.

1 I resumed charge of the Northern Division on the 19th September 1914 after an absence of 14 months.

The number of Agricultural Stations and plots remained the same as noted in last year's report with the additions of Kopergaon Fodder Farm and a small plot at Amalsad for sugarcane investigations.

CROPS.

COTTON.

Khándesh and the North Deccan.

2. The general organization of the seed supply of N. R. cotton has been described in previous reports. Briefly it consists of a 200-acre Departmental Seed Farm* located at Jalgaon, from which seed is supplied to selected persons called Registered Seed Growers on certain conditions. These are—

(1) The rate charged for the seed shall be 25 lbs. per rupee.

(2) It shall be sown in approved survey numbers to which officers of the Department shall have access and, if found necessary, authority to purify the crop at its expense, but without compensation to the grower.

(3) The Department shall have authority to supervise the ginning of the produce and the option to buy in as much seed as it requires at the rate of 25 lbs. per rupee. This seed is then distributed to the general public from several Government stores at the rate of 18 to 20 lbs. per rupee.

The following statement summarizes these transactions since the opening of the Jalgaon Farm in June 1913 :—

Year.	N. R. Cotton seed in lbs.		
	Produced on the Dhulia and Jalgaon Government Farms.	Issued to registered seed-growers.	Purchased in from registered seed growers for distribution to the general public.
1913-14	23,852	7,310 (13)†	91,277
1914-15	28,230	14,840 (24)†	108,839
1915-16	.....	18,472 (40)†	.....

† The figures in brackets show the number of Registered Seed Growers in Khándesh (East and West) and Násik Districts.

	Lbs.
East Khándesh	52,020½
West Khándesh	13,843
Násik	13,020
Nagar	11,210
Sholápur	600
Other places	583½

The details in column 4 for the year under report are shown in the margin. Those for 1915-16 will appear in next year's report.

In addition to pure N. R. seed 42,000 lbs. of ordinary Khándesh mixture cotton seed, produced at Chopda, was supplied to Nagar district.

No.	Name of place.	Ginning percentage.
	East Khándesh.	
1*	Mr. R. N. Balerao (Ráver)	Rejected.
2	,, R. S. Bengali (Amalner)	37·75
3	,, R. Y. Mandape (Yával)	38·5
4	,, P. G. Bendre (,,)	37·5
5	,, N. B. Bundelkhandi (Chálisgaon) ...	37·5
6	,, R. N. Paranjpe (,,) ...	38·5
7	,, Y. G. Deshpande (,,) ...	40·75
8	,, C. G. Deshpande (,,) ...	
9	,, Damoo Kolha	38·0
10	,, Ananda Balwant (Chálisgaon) ...	39·5
11	,, K. B. Phadnis (Nagardevla) ...	42·0
12	,, S. B. Phadnis (,,) ...	
	West Khándesh.	
13	Mr. M. A. Vaidya (Pimpri)	38·6
14	,, G. B. Patil (Songir)	38·0
15	,, V. D. Patil (Varkheda)	37·8
16	,, G. B. Sathe (Dondiachi)	38·2
17	,, S. V. Joshi (Shirpur)	37·9
18	,, Khedkar	Rejected.
19	,, G. Y. Parkhi (Nandurbar)	,,
	Násik.	
20	Mr. N. M. Powar, (Málegaon)	36·98
21	,, G. M. Powar (,,)	35·71
22	,, Shamji Patil (Tehre)	38·20
23	,, F. N. Palsikar (Málegaon)	36·21
2	,, L. Pophale (,,)	Rejected.

3. The registered seed growers in the year under report numbered 24 and their gross seed area amounted to 574 acres. It was found that the ginning percentage was better at some places than at others. The names of the growers, together with the ginning percentages of their seed cotton, are tabulated in the margin, from which it will be seen that Mr. Phadnis, of Nagardevla, whose seed cotton had a ginning percentage of 42 heads the list and that Mr. Powar of Málegaon foots the list. A few

* There is also a smaller Farm at Dhulia.

Name of District and Táluka.	No. of Registered seed growers.	Acreage.
East Khándesh.		A. g.
Amalner	3	48 0
Dharangaon	1	12 0
Ráver	1	17 0
Yával	3	38 0
Nagardevla	2	18 0
Edlabad	2	30 0
Páchora	2	37 0
Jámner	1	8 0
Chálisgaon	6	106 0
West Khándesh.		
Shirpur	2	65 11
Sindkheda	3	127 5
Sháhada	4	107 24
Dhulia	5	181 0
Násik.		
Málegaon	4	67 0
Satana	1	8 0
Total ...	40	870 0

seed growers have been dropped and others registered for 1915-16. In all there will be 40 registered seed growers with a gross seed-area of 870 acres distributed as noted in the margin. Including the Government Farm areas at Dhulia and Jalgaon, there will therefore be approximately 1,000 acres* devoted to seed production and hence in the event of the war terminating before June 1916 a rapid expansion of these operations will be possible.

4. As regards the seed distributed to the general public in the year under report it was found difficult to follow the fate of it all, but it is known that everywhere it resulted in heavier crops than those raised from the local seed, the difference in East Khándesh being estimated at 80 lbs. of seed cotton per acre. Occasionally one heard of a man who was under the impression that he was getting a smaller return. For instance, at Málegaon a certain cultivator holding this view showed his field to me in which both cottons were growing side by side. Arrangements were accordingly made to have the outturns carefully weighed and the verdict was found to be 10 per cent. in favour of the N. R. variety.

The ginning percentage was upwards of 38 to 39 per cent. or 3 to 4 points in advance of local cotton, and where the crop was not spoiled by rain at harvest time the clean-cotton fetched a premium of Rs. 2 to Rs. 5 per palla (240 lbs.) over local cotton on account of its superior colour, which was very white.

It has been computed that all these factors together must have enhanced the net profit per acre by some Rs. 8, and it was observed that many well-to-do cultivators ginned their seed cotton and retained the seed for sowing next season's crop. Naturally the price of seed-cotton ruled low in the year under report owing to the European war. At Dhulia for a maund of 144 lbs. the rate varied from Rs. 7 to Rs. 11 against Rs. 13 to Rs. 18 in 1913-14, while at Jálgaon it varied from Rs. 5-4-0 to Rs. 6 against Rs. 8-4-0 to Rs. 11-12-0 per maund of 96 lbs. in 1913-14. Unfortunately when a sharp rise in prices set in in March no one could take advantage of this as all the crop had been sold. The cultivators also suffered a good deal of loss from seasonal causes. There was too much rain in July and August, while the stormy weather in mid-September caused many flowers and immature bolls to drop off. Fair-season rain fell on several occasions and damaged the seed-cotton both in the field and in the ginnery yards.

5. As regards next season every effort has been made to carry on the work of introducing N. R cotton into general cultivation but the continuance of the war has made the distribution of highly priced seed very difficult, which was accentuated by the late setting in of the monsoon and the competition of Co-operative Societies which at Málegaon undersold the Department. Under these circumstances it was found impossible to distribute all the seed in the Government stores and a considerable quantity is left on hand; but fortunately experiments conducted at Dhulia show that this seed does not materially deteriorate in germinating power when kept over one season if the storage arrangements are good.

6. Selection in N. R. is in progress both at Dhulia and Jalgaon with the object of producing improved ginning strains of this cotton, but experience shows that the best results cannot be obtained at Dhulia, where there is something in the environment which tends to make the ginning percentage fall. At Jalgaon the selected plants have given a ginning percentage of 40 per cent.

7. At Dhulia a hybrid between Commilla and Bani cottons has been produced which gives considerable promise. Selection and extraction of desirable strains is now in progress and in the year under report several of these have given a ginning percentage of over 35 per cent., while in the case of one the ginning percentage exceeds 40 per cent. Samples of two strains of this cotton together with a sample of N. R., were submitted to the Trade for valuation with the following results :—

* This is exclusive of areas assigned to this purpose by Co-operative Societies and private individuals.

Name of cotton.	Note book description of fibre.	Report by the Ahmedabad Millowners' Association.		Report by Messrs. Tata Sons & Co. (through the Imperial Cotton Specialist).	
		Valuation* in Rupees per Khándi.	Remarks.	Valuation† in Rupees per Khándi.	Remarks.
		Rs.		Rs.	
Strain 1 of Hybrid Commilla × Bani.	Like Broach ...	145	Nice feel, staple fine .	190	We have compared the two samples and find No. 1 superior in length of staple to No. 2, though the latter is a bit superior in class to the former. Both are variable. Can spin 14s warp.
Strain 7 of Hybrid Commilla × Bani.	Like Surat ...	175	Superfine staple ...	185	
N. R. ...	Like Varadi ...	...	Very short and harsh. Similar to Khándesh but superior to Mathio.	165	This is a short stapled Jari cotton. Can spin 6s warp.

* The basis or valuation was Rs. 120 per khándi for Khándesh cotton.

† { Do. 175 do. of 784 lbs. for Khándesh.
Do. 220 do. do. Fine Broach.

It will thus be seen that we have some very promising material in this cross and that the fibre is much superior to that of N. R., while the ginning percentage is good, strain 1 giving 38·9 per cent. and strain 7 giving 35·9 per cent. in the year under report. There are considerable possibilities in this cross, but if the most is to be got out of it, it will require very careful and judicious handling.

8. The problem of improving the quality of Khándesh cotton will also be taken up next year by crossing N. R. with Bani, a cotton distinguished from all other Indian varieties for the quality of its fibre. It is difficult to obtain a pure culture of this cotton, but Mr. Leake of the United Provinces has kindly supplied a small quantity of seed. Work on these lines may lead to very valuable results if carefully carried out.

Surat District.

9. In previous reports the various schemes which have been tried for the marketing of the produce raised from improved strains of cotton have been discussed in detail, and it will be remembered that none of these have given complete satisfaction. In the year under report the Department has somewhat modified its policy with regard to improved strains of cotton given out to the public and has devoted more attention to supplying a cotton with an improved ginning percentage. It has been pointed out that the market is very unresponsive to small improvements in the quality of the fibre and hence the necessity in the past for the elaborate schemes alluded to above. It is a much simpler matter for a cultivator to reap the reward of growing a good ginning cotton, for the local merchants are generally willing to pay at least some premium on such a cotton, but the full increased value can be realized by a grower, provided he makes some arrangement for the ginning of his seed-cotton and selling his produce as clean-cotton instead of as seed-cotton. This procedure is not so easy nowadays since the disappearance of the hand-gin but it can be done given the necessary organization.

10. In the season under report, Mr. Bhimbhai, Divisional Inspector of Agriculture, Northern Division, devoted his attention to working out a scheme whereby the grower of improved cottons should be enabled to get his produce ginned and sold in the form of clean-cotton. The scheme was confined to the cultivators of a group of seven villages and a committee was formed with the Divisional Inspector as chairman and one or two representatives of each village, making eight persons in all. This committee represented all the growers of this cotton in the villages and had executive authority. Altogether 11,495 lbs. of seed was distributed and 559* acres were sown.

In the early part of the season samples of the cotton were forwarded to leading members of the cotton trade in Bombay and Ahmedabad and two firms offered to buy the clean-cotton at a premium. It was finally arranged to sell all the cotton to Messrs. Narandas Rajaram and Company,† who undertook to purchase it at a premium of Rs. 12 per candy over the current rates prevailing from time to time for local Surat cotton.

*The season was a wet one and much land had to be re-sown, while some cultivators did not sow cotton owing to the war.

† Mr. Thakardas of the firm of Messrs. Narandas Rajaram and Co. sent six bales consisting of cotton grown on the Surat Farm to Liverpool where it was sold for 5·41 pence per pound. This price was two points above that quoted for Middling American (*viz.*, 5·39) on the same day and was 15 points above the "future" quotation for August. The purchaser had previously tested one bale. The Liverpool report further adds "we anticipate a nice business next season if you can get this quantity in bulk." Mr. Thakardas also disposed of some of this cotton to local mills whom he reports were completely satisfied with it and concludes by pointing out that this cotton has met with the approval of those for whose custom the Department is catering.

It will thus be seen that the cultivator stood to gain in two ways by this scheme —

(1) he was to get the benefit of the higher ginning percentage by having his seed-cotton ginned and selling the clean-cotton and seed separately.

(2) he was to receive a premium on the clean-cotton.

Arrangements were made with Rajaram's gin at Sania to gin all the seed-cotton sent in by the Committee, under the supervision of a fieldman supplied by the Department and to take delivery of the cotton on behalf of its owner. The Committee met at regular intervals and watched the market movements, and when it saw a favourable opportunity it estimated the available quantity of seed-cotton ready for ginning and notified Messrs. Narandas Rajaram that it wished to sell this amount, and the sale was effected that day while the cotton was delivered as soon afterwards as it could be ginned. In this way the whole of the crop was sold off in three sales as follows :—

Date of sale.	Quantity of seed-cotton ginned.			Clean-cotton obtained.			Local current rate in rupees per khandi.	Premium in Rs. per khandi.	Rate at which sa was effected in rupees per khandi.
	Bhárs.	Maunds.	Seers.	Bhárs.	Maunds.	Seers.			
							Rs. a. p.	Rs.	Rs. a. p.
17th March 1915	87	11¼	10	32	3	3	222 4 0	12	234 4 0
26th March 1915	85	5	...	32	9	12½	218 4 0	12	230 4 0
7th April 1915	50	3	10	18	14	37¾	232 0 0	12	244 0 0

The seed was sold separately at rates varying from Rs. 24-4-0 to Rs. 26 per galli of 1,140 lbs. and the Department bought in some 23,000 lbs. at the latter rate for distribution purposes. The total realizations amounted to Rs. 22,591-5-2 and the expenses, including ginning, hire of bale covers, insurance and discount amounted to Rs. 1,080-14-10 leaving a net sum of Rs. 21,510-6-4 for distribution among the growers, who thus realized the following prices per bhár (924 lbs.) of seed-cotton. The current market rates are included in the statement for comparison :—

Date.	Prices realized by cultivators.	Current market rates.
	Rs.	Rs.
17th March 1915 ...	94 8 0	87 8 0
26th March 1915 ...	96 5 0	88 8 0
7th April 1915 ...	99 8 8	92 8 0
Average ...	96 12 7	89 8 0

It will thus be seen that the cultivator made a profit of 7½ per cent. on the transaction which consisted of 3/5ths on account of the premium on the lint and 2/5ths on account of the higher ginning percentage.*

11. It will be apparent that the new scheme has worked very well, but it was difficult at first to convince the cultivators of its feasibility and the difficulty of Jarap (or advance) sales had to be got over by arranging with some of the well-to-do cultivators to lend a little money to the poorer cultivators who could not wait till the end of the season for their returns. It is proposed to extend the scheme next year by forming a second group of villages, and ultimately it may be possible to organise the disposal of cotton produce on purely co-operative lines, but for some time the success of such a scheme will depend upon the personal direction of the Divisional Inspector of Agriculture.

12. A trial was made on the Surat Farm between one of the improved strains and ordinary deshi cotton with the following results. In order to ensure accuracy these cottons were sown on the same plot according to the alternate-two-row system :—

Name of cotton.	Number of plot.	Area.	Yield in lbs. per acre.		Ginning percentage.	Yield of clean-cotton in lbs. per acre.	Value of produce per acre in rupees.	Cost of production in rupees per acre.
			Seed cotton.	Stalks.				
						Lbs.	Rs. a. p.	Rs. a. p.
Selection I-A. ...	319A & B.	One acre.	853	1,820	36·1	308	94 2 9	12 7 8
Deshi			895	1,850	31·5	282	81 15 9	12 7 8

* It was a matter of some difficulty to ascertain the necessary data concerning the ginning percentage of deshi cotton, but the approximate difference between the ginning percentages of the deshi and improved cottons worked out at 2¼ maunds of kapas per khandi of clean-cotton in favour of the improved cotton.

As the land was in very good condition both cottons have yielded very highly and the deshi has given an appreciable higher outturn, than Selection I-A but probably the difference falls within the experimental error. There was however a great difference in the ginning percentage, amouting to 4·6 per cent. in favour of selection I-A, which turned a 5 per cent. deficit in yield of kapas into a 10 per cent. superiority in yield of clean-cotton in favour of Selection I-A.

13. Fifty pounds of clean-cotton (lint) from the general picking obtained from the offspring of last year's selected plants in two varieties, *viz.*, Selection I-A and Hybrid 1027 A L F-II were sent to Arudhya Spinning Mill of Ahmedabad for the purpose of spinning tests. For comparative purposes a similar sample of deshi Surtee-Broach was also forwarded to Ahmedabad.

The results of these trials are summarized in the following statement, from which it will be seen that the two improved cottons are substantially superior to deshi Surtee-Broach. In the case of the warp spinnings all these cottons were intentionally spun at 24^s.* The superiority of the improved cottons is brought out in columns 7 and 9. The former deals with the wastage which in the case of deshi Surtee-Broach is more than double of that in the case of the improved cottons, while this difference is largely due to the greater cleanliness of the improved cottons; still if we deduct that factor, the wastage is roughly 50 per cent. more in the case of deshi than in the case of improved cottons, and this is fairly evenly distributed over the blow-room and card-room. In fact, the loss from these cottons is as low as that given by imported American cotton.

From column 9 we learn that the improved cottons, and more particularly Hybrid 1027 A L F-II, are very much stronger than deshi Surtee-Broach: which means that higher counts can be spun. It is estimated that a good 28^s warp can be spun from Hybrid 1027 A L F-II.†

The sample of Hybrid 1027 A L F-II grown at Návsari has given rather disappointing results and shows superiority only in the factor of card-room loss: which means that the percentage of short fibres was low.

With regard to weft spinnings the superiority in strength of the improved cottons is again demonstrated.

Serial No.	Name of cotton.	Where grown.	Percentage loss.				Warp 24^s				Weft for 33^s			
			In blow room.	In card room.		Total.	Actual counts spun.	Tension in lbs.	Weight of 120 yards of yarn in grains.	No. of turns.	Actual counts spun.	Tension in lbs.	Weight of 120 yards of yarn in grains.	No. of turns.
				Short fibre.	Dirt.									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
								Lbs.	Grains.			Lbs.	Grains.	
1	Deshi Surtee-Broach.	Surat Farm ...	2·89	*3·28	5·75	11·92	25·0	5	40	23·07	33·3	30	30	27·7
2	Selection I-A ...	Do. ...	1·34	2·94	1·06	5·34	24·3	56	41	33·07	33·3	35	30	27·7
3	Hybrid 1027 A L F-II.	Do. ...	1·40	2·69	1·20	5·29	24·3	62	41	23·07	33·3	38·8	30	27·7
4	Do. ...	Sisodra plot near Navsári.	2·21	2·31	2·31	6·65	26·3	50	38	23·07	33·3	34	30	27·7

14. Selection within the several improved cottons on Surat Farm was continued in the year under report. The principal object now aimed at is to increase the ginning percentage. Several high ginning plants and several good ginning strains have been secured. It will be of interest to give the history of Selection I-A, which has been selected with this object in view since 1908-09.

Name of variety of cotton.	Ginning percentage (General sample) during—						
	1908-09.	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.
Selection I-A ...	33·05	33·4	33·6	35·3	35·0	37·35	37·4

It is important to point out that the improvement in the ginning percentage has not been secured at the expense of the weight of the individual seeds. Careful weighments show that the seed of the improved cottons is heavier than that of deshi cotton.

* The millowner spun these cottons for 24^s warp and 33^s weft, irrespective of quality, owing to the strike of some mill-hands.

† Messrs. Tata Sons and Company, Bombay, after examining a hand sample of this cotton grown at Surat expressed the following opinion:—

"This is in no way inferior to Navsári cotton. The cotton is long stapled, silky and strong in fibre. Good for spinning 40^s warp."

Broach District.

15. The cotton in this district everywhere consists of a mixture of Broach and Ghoghári varieties in varying proportions. Ghoghári appears to have spread from Jambusar táluka, where it is found in highest proportion, and the cause of its gradual spread into other tálukas is undoubtedly its higher ginning percentage compared with Broach. At the present time cultivators everywhere prefer this variety or a mixture containing it to pure Broach. The substitution of pure Ghoghári in place of pure Broach would add materially to the export of clean-cotton from the district, as may be gathered from the following figures obtained on the Departmental plot at Broach in the year under report :—

Name of variety.	Quantity of seed-cotton in lbs. ginned.	Quantity in lbs. obtained.		
		Seed.	Lint.	Wastage.
	Lbs.	Lbs. tolas.	Lbs. tolas.	Lbs. tolas.
Broach-Deshi	20	12 24	7 4·75	0 10·25
Varnama Ghoghári	20	11 20·25	8 9	0 9·75

These figures show that the production of clean-cotton would be increased by 15½ per cent., if we assume that the yield of seed-cotton remains the same. There is some evidence that on the very heavy black soils Ghoghári does not yield quite so well as Broach, but the difference does not appear to be very great, and in the year under report on the Departmental plot Ghoghári yielded rather better than Broach. However, more data is required on this point.

16. In the year under report the Departmental plot was increased to 27 acres and work was commenced in isolating the different types of Ghoghári. Four main types have been recognized and a large number of plants in each type have been selected and the seed of each plant will be sown separately next season. Among these we seem to have secured some excellent material as the average ginning percentage of 188 plants in type A was 45·2 per cent.

17. The Ghoghári fibre is somewhat shorter than Broach, but its colour is superior, being distinctly whiter than that of Broach. Samples of A and B types of Ghoghári together with a sample of Broach deshi were submitted to the Trade for valuation and opinion with the results tabulated below, which show that there is not much difference in value between these cottons:—

Name of cotton.	Report by the Ahmedabad Millowners' Association.		Report by Messrs. Tata Sons & Co., Bombay (through the Imperial cotton specialist).	
	Approximate valuation in rupees per khandi.*	Remarks.	Valuation in rupees per khandi.†	Remarks.
Broach-Deshi ...	175	Irregular in staple; suitable for spinning 18s warp.	205	This cotton is very irregular; some staple is long, some short. It has not the soft feel of Broach cotton. Can spin 16 warp.
Ghoghári A type ...	164	More bulky, coarse, with good colour; suitable for spinning 16s warp.	215	It is superior in class but somewhat shorter in staple than Broach. Can spin upto 16s warp.
Ghoghári B type ...	172	Rougher than Broach-deshi; suitable for spinning 18s warp.	212	A little inferior in class to above.

* Basis for valuation was Rs. 220 for Surat.

† Do. { Rs. 220 for fine Broach. Rs. 240 for fine Surát. Rs. 265 for fine Navsári.

18. Arrangements, however, have been made for producing some crosses next season between Ghoghári A type and Bani with the object of breeding a hybrid which will combine the high ginning percentage of Ghoghári with the fine fibre of Bani, but this work will require the most careful attention if it is to succeed.

Kaira and Panch Mahál Districts.

19. There was very little cotton cultivation in the Kaira district a decade ago, except for the Rozy variety which is a perennial and grown as a mixed crop with bájri, etc., and whose fibre is very coarse and short, and ginning percentage very low. In recent years, however, nearly every village can show at least a small area under Kanvi cotton which has been imported from the Kanam tract lying to the south of Baroda and north of Broach. Recently, the Department was asked to supply 6,000 lbs. of this seed to the Mehmedabad Co-operative

Society. This cotton is simply a local strain of Broach with a mixture of Ghoghári. This change has been brought about by the high rates prevailing for cotton in the past few years, and the comparative ease with which cash can be realized from this crop, and perhaps something may be ascribed to the work of the Department on the Nadiád Farm. This crop is extending rapidly in the Thásra táluka, where large areas of grass land have been given out for cultivation and where recently the Department introduced steam cultivation. Similarly, in the adjoining district of the Panch Maháls the area under cotton is rapidly extending. Under these circumstances there is a considerable field for work by the Department in organizing the seed supply of the most suitable variety for this tract. In this connection the work conducted at Nadiád if of great importance where exhaustive experiments with Egyptian, American, Cambodia, Buri, Lalio and Ghoghári cottons have been conducted and from which the following conclusions have been drawn :—

(1) Where irrigation facilities are available in May the most profitable cotton for a careful man to grow is Cambodia in spite of the fact that owing to deterioration in ginning percentage fresh seed at frequent intervals is necessary. This cotton on land free from "wilt" (*Fusarim sp.*) is extraordinarily prolific, as will be gathered from the following results obtained on well treated plots :—

Season.	Yield of seed-cotton in lbs. per acre.	Remarks.
	Lbs.	
1912-13	1,592	
1913-14	1,041	
1914-15	1,405	Notwithstanding a severe attack from *aphis*, which made the plants drip for a couple of months.

(2) For the average careless cultivator (who represents the majority) with or without irrigation facilities in May the safest variety to grow is probably Ghoghári, which is a constituent in the mixture of Kanvi, now being imported into the district.

(3) Where the land is badly infested with "wilt" (*Fusarium sp.*) it is inadvisable to grow any cotton.

Comparative experiments with the most promising varieties have been conducted for the last three years with the following average results :—

Name of cotton.	A.		B.		Remarks.
	Ginning percentage.	Yield of seed-cotton in lbs. per acre.	Ginning percentage.	Yield of seed-cotton in lbs. per acre.	
		Lbs.			
Buri ...	29·82	396	30·21	480	All monsoon sown.
Cambodia ...	33·25	356	33·29	490	
Lalio ...	35·36	657	34·83	653	
Ghoghári ...	37·59	520	37·18	854	

Treatment A—Never irrigated. Treatment B—Irrigated once or twice in the cold weather.

It will be noted that Ghoghári cotton yields satisfactorily and that in ginning percentage it stands well ahead of all other cottons, and this character of ginning percentage has been well maintained throughout the three years and different treatments, which is not the case with other cottons which have a high reputation for ginning capacity. In comparison with Lalio it is true that the fibre of Ghoghári is not so good, but this is not a serious drawback as the market is very insensitive to differences in quality.

20. It therefore appears to be expedient for the Department to introduce the best type of Ghoghari seed into these two districts, and this task will be facilitated by the work now in progress at Broach where the different types of Ghoghári are being isolated and grown in pure cultures.

21. For the two tálukas of Dohad and Jhálod in the Panch Máhals, N. R. cotton has now been definitely selected for the black soil areas and experiments are in progress to ascertain the most suitable rotation in which to grow this crop. On the brown soil areas it has been decided not to introduce any cotton as other crops and rotations have proved more suitable for such lands.

Wheat.

22. At Dohad comparative trials with several varieties of soft and hard wheats have resulted in a marked superiority in favour of soft wheats for brown soils and also for black soils where irrigation facilities exist. Among the soft wheats there is not much to choose between Pissi, Wagia and Hybrid of Nagpur × Muzaffarnagar as regards outturn but taking previous results into consideration there seems to be no variety superior to Pissi for this locality. For the black soil areas where no irrigation facilities exist probably Bansi of West Khándesh is the most suitable variety. Pusa No. 4 was tried on a small scale and, but for the germination being poor, it looked a promising wheat for Dohad.

23. At Nadiad Támra (a hard yellow wheat) was the only variety to leave a profit in the year under report owing to the damage caused by rust, white ants, stem borer and rats. This variety was less affected by rust than any other except the local khapli (or Popatia) wheat and it has done uniformly well since its introduction from the United Provinces in 1909-10 as may be gathered from the following statement; it has accordingly been decided to reject all other varieties and to accept Támra as the most suitable variety for Nadiad conditions :—

Year.	Yield in lbs. per acre.			
	Támra.		Local Khapli.	
	Grain.	Straw.	Grain.	Straw.
	Rs.	Rs.	Rs.	Rs.
1909-10	1,501	3,840	.....	.....
1910-11	1,152	3,008	.....	.....
1911-12*	844	2,604	1,040	2,776
1912-13	1,350	2,430	1,110	2,938
1913-14†	874	2,760	678	1,353
1914-15	1,306	3,590	1,033	2,804
Average	1,171	3,039	965	2,468

* This was a scarcity year when all crops yielded poorly.

† The crop was seriously damaged by rats and white ants and stem borers were also severe as were also rust an smut but Támra suffered less than other wheats from these fungoids.

24. Selection is in progress with this crop at Dohad and Dhulia.

Jowar.

25. A comparative trial was conducted at Surat to compare pedigree seed with ordinary bazar seed. The results are noted in the following statement from which it will be seen that the superiority of pedigree seed is brought out in the case of Perio and Chapti varieties while the Sholápuri pedigree seed has done badly confirming last year's result and indicating that this strain is a poor one :—

Plot No.	Name of variety.	nd of seed.	Yield per acre in lbs.		Value of produce in Rs. per acre.	Cost of production in Rs. per acre.
			Grain.	Kirbi.		
					Rs. a. p.	Rs. a. p.
346 C	Perio ...	Pedigree ...	1,248	2,366	77 7 0	11 15 6
346 D	Do. ...	Bazar ...	893	1,769	55 2 4	11 15 6
346 E	Chapti ...	Pedigree ...	1,355	2,244	79 3 7	11 15 6
346 F*	Do. ...	Bazar ...	658	1,249	39 14 8	11 15 6
346 G	Sholápuri ...	Pedigree ...	682	1,052	39 0 6	11 15 6
346 H	Do. ...	Bazar ...	769	1,109	43 4 6	11 15 6

* This plot had to be resown on the 21st August.

Selection is in progress with this crop at Surat.

Groundnuts.

26. At Surat Spanish peanuts grown as a dry crop on an area of 4 acres yielded at the rate of 1,219 lbs. of nuts and 2,088 lbs. of creepers per acre and left a substantial profit of Rs. 55-6-6 per acre but there is no indication that this crop is going to be taken up on black cotton soil in this locality due chiefly to the expenditure involved in protecting it from jackals and crows.

27. At Dohad this crop was badly damaged by rats on the brown soil area where Japanese Small grown as a dry crop yielded only 750 lbs. of nuts per acre. On the black soil area Spanish peanuts grown as a dry crop yielded at the rate of 1,191 lbs. of nuts per acre.

As a result of demonstrations with this crop groundnuts are beginning to find favour in the neighbourhood of Dohad as may be gathered from the following figures but rats are a formidable obstacle and the question of arrangement of farm work is also involved as the people first of all harvest the maize crop and prepare the land for rabi sowings by which time the soil has set hard and groundnuts are difficult to raise :—

Year.	Area under groundnut in acres.	Remarks.
1910-1911	25	
1911-1912	150	
1912-1913	353	
1913-1914	686	
1914-1915	700	Approximately.

On the Dhulia Farm a (dry crop) yield of 2,138 lbs. per acre of Spanish peanuts over an area of 2¾ acres was obtained, leaving a profit of Rs. 71-6-6 per acre. Spanish peanuts are becoming popular in Khándesh as they mature early, are independent of irrigation, rotate well with cotton, provide a bye product of nutritious fodder and are a good cash making crop.

In the year under report the Department distributed 10,681 lbs. of seed of this variety chiefly in Khándesh. The village of Thorgawan in Raver Táluka alone took 5,000 lbs. of seed and sowed 100 acres with this crop as a result of the show and demonstration held at Savda. Mr. Tukaram Chandoo Patil of this village sowed 5 acres and estimated the outturn at 960 lbs. per acre worth together with the creepers and the subsidiary crop of jowar Rs. 91-12-0 and costing Rs. 36-6-0 to produce, so that a nett profit of Rs. 50 to Rs. 60 was gained. 21,845 lbs. have been purchased for distribution next year, while a private cultivator is also stocking 12,000 lbs. for distribution.

Tur.

Some progress has been made in isolating the several types found in local tur at Nadiad and a small quantity of the white seeded type has been secured.

Similar work is in progress at Surat.

Other Crops.

Isolation and selection of pure cultures are in progress with bájri, castors, til and guvar at Nadiad and maize and gram at Dohad.

2.—CULTURAL EXPERIMENTS.

32. In South Guzerat a strong case for steam ploughing has been made out through the work of the Bajac plough. The quality of the work done by this plough is about equal to that of a steam plough but the quantity is very small and the cost very high. In the north-east of Olpad táluka the land is heavily infested with deep rooted weeds like Dabhdo (Andropogon sp.) and fields ploughed with the Bajac plough have given a good return in jowár but there are signs that these weeds again strongly establish themselves in the course of five years owing to the very retentive nature of these soils and hence deep ploughing once or twice in a decade will be essential if satisfactory yields are to be obtained.

33. At Dohad an experiment has been conducted for some years to ascertain whether the local practice of sowing maize by means of a plough can be improved upon by introducing drilling. The problem really turns on the necessity for prompt sowing at the very first opportunity in order that the crop shall mature sufficiently early to enable a good seed-bed to be prepared for the second crop in the rabi season. Drilling would no doubt be the best method if there were time to prepare the requisite seed bed for a drill to work in but the available time between breaks in the rains is an uncertain quantity and a much greater area can be sown in a given period by the plough than by the drill as the former method is possible without any preparatory tillage and the crop usually does quite well particularly if the land carried a crop of wheat in the preceding year for which good tillage had been given. The season was a bad one owing to continuous wet weather in July and August but the results are given for comparative purposes in the following statement from which it will be seen that the drilled crop has not done as well as the crop sown with a plough :—

No. of plot.	Area in gunthas.	Method of sowing.	Yield per acre in lbs.		Remarks.
			Grain.	Stalks.	
53	17·5	Sown with a plough ...	1,086	2,270	The distance between the rows was 18".
	17·5	Drilled ...	1,026	2,000	

34. At Surat it has been shown that dibbling cotton seed on the flat can be practised with advantage after the rains have set in except where the areas are large in which case drilling is the only practicable method. Dibbling is very useful on dirty land as it can be so arranged that inter-cultivation is possible in three directions.

35. At Jalgaon it was found that the cotton, sown on land which had been deep ploughed with an iron (S. A. E.) plough, suffered severely from the heavy rainfall as the loose soil absorbed so much moisture that all the leaves dropped off the plants at the end of July and the crop had to be grubbed up; in future it has been decided to sow a rabi crop on land which has required deep ploughing for cleaning purposes.

36. An experiment has been conducted at 'Nadiad for six years to ascertain the correct number of paddy seedlings which should be sown in one bunch for the local conditions obtaining in North Guzerat where irrigation water is under control. The results which are summarized below, show that one seedling is not sufficient but not more than two seedlings per bunch are required:—

No. of seedlings per bunch.	Average outturn in lbs. per acre.		Remarks.
	Grain.	Straw.	
1	1,845	2,822	
2	2,266	3,194	
3	2,254	3,452	

37. An experiment in salt land reclamation is being jointly conducted by the Department and the owners at Pinjrat in Olpad táluka where an efficient bund protects a flat area of some 800 acres from sea-water. The procedure adopted has been to construct a tank on the inland edge of the area, which becomes filled by storm water from the surrounding higher lands and to lay out a series of kyari fields under the command of this tank in which salt paddy is sown. The crop in this, the first year of the experiment, did well where it could be adequately irrigated and the work promises to prove successful. If this be so, the method will be applicable to the great Shriford reclamation scheme in Jalalpur táluka and many other similar enterprizes along the coast.

3.—MANURIAL EXPERIMENTS.

38. An experiment has been conducted at Nadiad for five years to test the value of several cake manures on the tobacco crop. The results are summarized in the following statement from which it will be seen that castor cake has increased the outturn by 36 per cent and the nett profits by 70 per cent:—

Name of cake manure.	Quantity of cake in lbs. per acre in addition to 20,000 lbs. o farm yard manure.	Average yield of cured leaf in lbs. per acre.	Average net profit in Rs. per acre.	Remarks
			Rs. a. p.	
Nil	.....	1,584	31 11 1	
Castor cake	1,000	2,156	54 0 11	
Cotton seed cake... ...	1,000	1,924½	29 9 0	
Groundnut cake	1,000	2,009	30 8 11	
Safflower cake	1,000	2,081	47 14 8	

Castor cake cost 45¾ lbs. per rupee.

39. Good results have again been obtained at Surat with poudrette and mowhra refuse manures on cotton and jowar. The residual effects of night soil were again very marked but the presence of gunderdo (Cyperus rotundus) weed has materially interfered with the results on cotton.

4.—ROTATIONAL EXPERIMENTS.

40. An experiment has been conducted at Dohad for three years to ascertain whether paddy followed by some rabi crop is a more profitable rotation than maize followed by wheat on brown soil where irrigation facilities exist and the results so far as they go indicate that the local rotation of maize and wheat is much the more profitable.

(1) because the paddy crop is an uncertain one being dependent on irrigation from the Muvalia Tank which does not fill up when the rainfall is gentle;

(2) it is difficult to get the land ready for a rabi crop after paddy as it remains wet for a long time.

5.—PREVENTIVE MEASURES AGAINST CROP PESTS.

41. *The North-West Locust* (Acridium succintum).—For the last year or two large swarms of North-West locusts have appeared over north Guzerat and Kathiawar and have come apparently from Sind and Rajputana. In the year under report they appeared in the last week of June, hovered over north Guzerat for about a week without doing any damage as there were no crops at that time and disappeared in the direction of Rajputana and Central India, while some perished in the sea. A few however deposited eggs at Piplodi and Dalalpur in Prantij and Modasa talukas respectively and in a portion of Idar state. The hoppers emerged from the eggs about six weeks later and prompt measures were at once taken by the Agricultural and Revenue Departments to destroy them. Within a period of one week 644,560 hoppers weighing nearly half a ton were killed at Dalalpur village alone on an area of 50 acres at a cost of Rs. 50 before they were able to cause any damage. It was also observed that birds such as *mynas* fed voraciously on the hoppers and materially assisted in destroying them.

42. *Mites* (Ratadia) have proved a serious pest on kharif jowar in the four talukas—Jalalpur, Bardoli, Mandvi and Valod of Surat district—proving very severe in the villages of the first named where field after field of jowar could be seen from a distance discoloured red and totally dried up and bearing diminutive ear heads. The disease is caused by colonies of these mites which are very small and coloured either red or yellow, appearing on the under-side of the leaves where they attack the epidermal tissue and deprive the plant of nourishment and cause it to turn red and dry up. Spraying operations with lime and sulphur were conducted in four villages of Jalalpur taluka in the month of October and these proved effective by destroying most of the colonies and checking the development of the remainder. The financial results of the work are summarized in the following statement:—

Serial No.	Name of village.	Area treated in gunthas.	Kind of treatment.	Cost of spraying including labour per plot.	Yield per plot.		Yield per acre.		Value of produce per acre.	Cost of spraying per acre.	Gross profit per acre.
					Grain.	Kadbi.	Grain.	Kirbi.			
				Rs. a. p.	Lbs.	Bundles.	Lbs.	Bundles.	Rs. a. p.	Rs. a. p.	Rs. a. p.
1	Virvad ...	5	Lime and sulphur spraying.	0 12 3	54	14	432	112	21 8 0	2 0	15 6 0
2	Do. ...	5	Untreated	...	Nil.	12	Nil.	96	2 6 4	...	2 6 4
3	Do. ...	5	Normal crop unaffected ...	...	93	18	744	144	36 2 4	...	36 2 4
1	Kharsad ...	4	Lime and sulphur spraying.	0 9 9	45	20	450	200	24 11 0	6 2 0	18 9 0
2	Do ...	4	Untreated	Nil.	Nil.	10	Nil.	100	2 8 0	...	2 8 0
3	Do. ...	4	Normal crop unaffected ...	...	60	25	600	250	32 8 0	...	32 8 0

It will be noted that for an expenditure of Rs. 6-2-0 per acre a profit of Rs. 21-8-0 to Rs. 24-11-0 against Rs. 2-8-0 per acre has been secured and still better results would probably have been obtained if the work had been taken up as soon as the mites had made their appearance.

43. *Cotton Leaf Roller* (Sylepta derogata).—This is a very injurious pest when it becomes well established. An attack broke out at Nadiad in the second week of August and hand picking by children was carried out on five occasions when the pest disappeared. At each of these pickings thousands of these rollers were removed and the total cost amounted to only Rs. 6-11-0 per acre which does not appear a large sum to incur in saving a crop.

44. *Borer* (Chilo simplex).—There was a very severe attack on jowar at Surat in 1912-13 extending to some 60 per cent. of the plants. The affected stems were cut off and burnt for an expenditure of Rs. 1-2-0 per acre and the crop yielded at the rate of 316 and 688 lbs. of grain per acre (according to variety). Unfortunately there was no control plot but the expenditure appears small in comparison with the probable saving.

45. *Rats*.—Rats sometimes increase to such an extent that they amount to a plague and the damage they cause to most crops is common knowledge as for example dragging cotton bolls off the bushes and cutting off wheat ear-heads and removing these to their underground homes. A very successful method of destroying rats in the field was

hit upon by Mr. Jhaveri in the year under report, who used the white-ant exterminator for the purpose. This is merely a machine in which sulphur fumes are produced and pumped out by means of a pump and a hose In this way one rat hole can be fumigated in two or three minutes for which one tola of flowers of sulphur and a negligible quantity of charcoal are required. By this means some 60 to 80 distinct rat excavations can be dealt with in a day by a party consisting of 2 or 3 coolies and one machine for a total cost of less than one rupee. Where there are several holes or entrances leading to the same excavation only one fumigation is necessary as the other holes can be blocked up with earth.

46. *Stored seeds.*—Carbon bisulphide used at the rate of one ounce per 150 to 200 lbs. of grain put into the bins along with the seed and the outside immediately closed up is used as an effective means of preserving seeds on all the Government Farms and recently demonstrations have been conducted on a large scale at Jambusar and Nadiad with cultivators' and merchants' stocks with excellent results. The loss incurred by grain merchants from weevil and other granary insects is well known to be enormous.

47. *Potato moth* (Phthorimæa operculella).—Experiments were conducted at Khed in the year under report to further investigate the best method of preserving potato seed from the rabi harvest in March till the monsoon sowing season in June. 40 pallas or 11,200 lbs. were purchased and were stored in bags while 10 pallas or 2,800 lbs. were stored in a sand heap. The sand method again proved a failure owing to the enormous loss from rot due to the high temperature which generates in an unventilated heap of potatoes covered over with sand. Special precautions were taken to maintain a cool dry atmosphere around the bags by careful protection with dry grass and adequate ventilation and the results were good. The loss from dryage was 14·1 per cent. and the loss from rot was 3·5 per cent., making a total loss of 17·6 per cent.

The financial results are tabulated below.

Balance sheet of the Potato storage experiment (the bag method).

Expenditure.	Amount.			Amount.					
	Rs.	a.	p.		Rs.	a.	p.	Rs.	a. p.
Purchase of 10,080 lbs. of potatoes at Rs. 6-10-0 per palla of 280 lbs. at Khed.	238	8	0	Sale of 3,990 lbs. of potatoes at Rs. 10 per palla of 280 lbs.	142	8	0		
Purchase of 1,120 lbs. of potatoes at Rs. 6-10-0 per palla of 240 lbs. at Pith.	26	8	0	Sale of 4,278 lbs. of potatoes at Rs. 8-15-7 per palla of 240 lbs.	137	4	0		
								279	12 0
Purchase of 59 bags for storing at annas 7 per bag.	25	13	0						
Purchase of rice straw	4	8	0	Sale of 950 lbs. of potatoes at Rs. 9-9-3 per palla of 280 lbs.				32	8 0
Purchase of cloth for closing windows.	1	0	0						
				Sale of rice straw				2	0 0
Labour for fumigating potatoes and filling them into bags.	4	8	0						
Labour for turning potatoes three times for removing rotted ones.	5	6	0	Estimated value of gunny bags at annas 6 each.				22	2 0
House rent for storage for 3½ months.	6	2	0						
	312	5	0						
Net profit ...	24	1	0						
	336	6	0					336	6 0

6.—THE KANKREJI BREEDING HERD AT SURAT.

48. Good progress continues to be made with this herd. The strength of the herd on the 1st April 1915 was 88 of all classes against 77 on the same date last year and the production of milk went up to 60,472 lbs. yielded by 22 cows against 50,055 lbs. yielded by 21 cows in 1914 in addition to what the calves sucked. This gives a return of 2,748·7 lbs. per head per cow against 2,385·5 last year. The milk is sold at the high rate of 1½ annas per pound and although the whole of it cannot be disposed of at that rate and the balance has to be converted into ghee, it can be demonstrated (*vide* paragraph 103 of Surat report for 1914-15) that this arrangement brings in a greater nett return than selling the whole of the milk for 1¼ annas per pound.

49. No serious effort has yet been made to substitute separated milk and oil for the practice of allowing the calves to suck their dams but this should prove quite feasible except in the case of the selected bull calves to whom it may be desired to give the special advantage of sucking. The introduction of this practice would largely solve the problem of how to dispose of the separated milk. A weak point in Indian cows is their long dry period but we now have a few cows which calve at the rate of once a year and in the case of this herd it can be shown that the young cows are producing their first calf at an earlier

age than did the old cows, while there seems to be some ground for assuming that the dry period is becoming less among the young cows and hence the effect of the bull purchased at Rádhanpur some seven years ago is now influencing the breeding and milking qualities of the herd. Attention may be caled to the young cow Lahera which has had two calves at the rather long interval of 17 to 18 months but was dry only for six weeks of that period. Her average daily milk yield (lumping lactation and dry periods together) works out at 13 lbs. and the annual value of her produce exceeds Rs. 300. These figures are helped by the fact that the period includes two lactations and one dry spell.

50. The young bull-stock is rigidly selected and only the very best are retained. In the course of the year one young bull, rising 4 years, was sold to the Government of Trinidád for Rs. 500.

51. The financial condition of the herd is still not quite satisfactory, there being a balance loss of Rs. 800 in the year under report, but this was due to the high rates which are charged for food stuffs, much of which are supplied from the experimental Farm at current rates. If these were charged for at cost rates then the balance sheet for the herd would show a profit of nearly Rs. 1,500 for the year under report.

7.—IMPLEMENTS AND MACHINERY.

52. Further experience with the 2-gang Bajac geared plough shows that on heavy black cotton soil the draft is very heavy and a tentative conclusion is that for ploughing such soils bullock power is not quite suitable and is moreover very expensive. It seems probable that steam alone will prove economical for such soils. Sufficient land has now been ploughed with the Bajac plough to show that this kind of tillage is well suited to such soils.

53. No new implement of special interest was introduced in the course of the year but disc harrows are establishing their claim to a place in Indian Agriculture; however, their cost at present is rather prohibitive. A light cultivator for breaking up light black soils has also given promising results at Kopergaon.

54. A trial conducted with Hunt's Simplex rotatary manual chaff cutter costing Rs. 43 resulted in an outturn of 608 lbs. of chaffed kirbi from rather coarse jowar in a day at 8 hours. The labour required was two men and one boy. The kirbi was cut into pieces of ½ an inch in length and the cost worked out at something over Rs. 1-9-0 per 1,000 lbs.

55. Demonstrations with the iron mhôt in Khándesh are gradually succeeding in breaking down the local prejudice against these useful machines due largely to a lack of knowledge in how to fix them. Messrs. Bhide and Company, of Sangli, manufacture different sizes of these mhôts. The 55-gallon one costs less than Rs. 16 and has a life of three years if carefully looked after. Owing to the great rise in the price of leather in recent years the leather mhôts cost Rs. 19 to Rs. 21 nowadays and last for only one season.

56. An interesting machine called "B & H" Pear Burner has been obtained from Texas, where great success has been claimed for it in burning off the spines from standing prickly-pear, thus enabling stock to graze on this plant and saving expensive handling charges. The machine consists of a 2-gallon vessel to which is fixed an air pump and from which a metal lance tube leads to a vaporizer some four feet away. The vessel is hung over the shoulder of a man who holds the metal lance-tube in one hand. Petrol is filled into the vessel till it is 2-3rds full and air is then pumped in so that when the cock in the lance tube is opened the petrol is forced out. A light is applied to the end of the vaporizer and a strong flame which can be regulated by opening and closing a cock is at once produced at the end of the lance which can be freely moved about in all directions. Trials show that there is no difficulty in burning off the spines and experiments are now in progress to teach cattle to feed on the pear after treatment. The whole machine costs Rs. 68-2-0 landed in Poona, and it promises to be invaluable in the case of a fodder famine in the East Deccan, but the man who uses it must be taught to understand the great inflammability of petrol and to take great care to prevent any leakage from the joints in the lance tube.

57. It is of interest to note that the Sultan Sugarcane Mill is gaining much favour in the Násik District where khadya cane is grown. A trial taken at Pálkhed resulted in an extraction of 71·35 per cent. against 63·88 obtained with a Poona mill. This mill requires one man to feed the cane and one pair of bullocks. The cost is Rs. 162 and the output from 400 to 500 lbs. of cane per hour.

8.—IMPLEMENT DEPÔTS.

58. In 1913-14 three implement depôts were opened at Málegaon (Násik District), Vadála (Nagar district) and Hadapsar (Poona district). The object of these depôts was to stock a few ploughs and other implements to be hired out to cultivators, as experience had shown that one of the chief reasons why cultivators did not adopt new implements on a more extensive scale was largely because they could not afford the initial outlay. The depôts have

proved very successful and have been extensively patronized by the local cultivators. It will therefore be of interest to give a balance sheet of one of them for the year under report in order to illustrate the financial feasibility of such depôts.

Balance sheet of the Hadapsar implement Depot for the year 1914-15.

Expenditure.				Receipts.	
Items of expenditure.	Original value of implements.	Age of implements.	Amount of charges.	Items.	Amount.
	Rs. a. p.		Rs. a. p.		Rs. a. p.
Store Enclosure	93 0 0	2 years.	.....	Hire Account plough .	115 0 0
5 Arlington ploughs ...	203 2 0	Do.	.....		
1 Scraper	19 11 0	Do.	.....	Hire Account Scraper.	4 15 0
6 C. T. Ploughs	276 0 0	6 months.	.....		
* Interest on Rs. 295-14-6, *i.e.*, on half the value of the implements at 9 per cent.	.....	.....	26 10 1		
Depreciation on Rs. 315-13-0 at 10 per cent.	.....	.....	31 9 3		
† Depreciation on Rs. 276-0-0 at 5 per cent.	.....	.....	13 12 9		
Repair charges	.....	.....	7 13 0		
Balance profit	.....	.....	40 1 11		
Total ...	591 13 0		119 15 0	Total ...	119 15 0

* Interest is charged on half the original capital value because this represents the average interest throughout the life of the implement.

† C. T. ploughs were purchased in December 1914 and so only 5 per cent. Depreciation is calculated.

Name o District.	Name of Depôt.	Value of dead stock.
		Rs. a. p.
Poona ...	Loni ...	399 5 1
	College Farm ...	348 12 0
	Mandangaon ...	366 9 0
	Peith ...	115 4 0
Nagar ...	Shrigonda* ...	505 10 4
	Shevgaon ...	543 2 11
	Pohegaon ...	2,258 4 0
	Mahálkheda ...	
	Rahata ...	
West Khándesh ...	Dhulia Farm ...	154 8 0
	Shirpur ...	441 14 8
	Dondiáchi ...	441 14 8
East Khándesh ...	Jalgaon ...	213 3 5
	Amalner ...	264 10 7
	Cháliscan ...	267 8 5
Násik ...	Málegaon ...	850 14 9

* Not yet opened.

59. At the Vádala Depôt a single plough costing Rs. 46-8-0 has earned no less than Rs. 33-12-0 in hire charges in the year under report. During the year under report there has been an active demand for more implement depôts and accordingly new depôts have been opened at the places noted in the margin.

60. The implements stocked in these depôts include—

(Name of implement.)	(Hire charges per day.)
	Rs. a. p.
Ransomes' C. T. ploughs	0 3 0
Do. B. T. ploughs	0 3 0
Arlington ploughs	0 3 0
Scrapers (*i. e.*, levellers)	0 1 0
Hand hoes	0 1 0
Disc harrows	0 2 0
Cane crushers (sugarcane)	1 0 0
Wheat threshers	0 4 0

In those places where people require instruction an expert ploughman is supplied for a charge of 8 annas per day.

In order that the implements should not be left idle when any small thing goes wrong a special man on Rs. 16 per month has been appointed to look after the implements of all the depôts within a certain circle. His duty is to visit each depôt in turn and examine the working of those implements which happen to be out on hire and to assist the people in adjusting them and in carrying out small repairs where necessary. Steps have also been taken to stock a full supply of spare parts at each depôt.

61. These depôts are managed by the Department, but it is hoped very soon to transfer them to some other agency, as the number might soon exceed the limit which the Department could manage. A beginning has been made in this direction with the Hadapsar depôt. At that place the local Co-operative Credit Society is considering to take over the dead stock at a valuation and run the depôt as an integral part of the Society's operations. The Shirpur Agricultural Association has taken over the Departmental depôt at Shirpur. The Co-operative Credit Societies of Dupkheda and Daregaon in Násik District have each laid in a large stock of ploughs for hire to their members. In this connection it is interesting to note that there are signs of public enterprise. Information has been received from Sirur and Haveli Tálukas of Poona District that private individuals have started a business in the hire of ploughs, charging Rs. 5-8-0 to Rs. 7 per plough per month.

62. In addition to keeping implements for hire, arrangements have been made to keep in these depôts a stock of implements for sale on behalf of manufacturing firms or their agents. In the year under report the sales from two of these depôts were as under—

Name of Depôt.	C. T. Ploughs.	Hand Hoes.	Total value in rupees.
			Rs. a. p.
Vadála	16	.....	736 0 0
Nagar	6	12	445 8 0

63. At the Málegaon depôt a stock of cake manure was also held for the benefit of cane growers and cake to the value of Rs. 500 (18,280 lbs. of castor cake) was sold to cultivators in Málegaon, Násik, Niphád and Dindori Tálukas. In this locality no cake manure is used, neither is it the custom to earth up sugarcane. Accordingly whenever cake was sold a demonstrator was sent to show how it should be applied.

64. The foregoing remarks refer to Khándesh and the North Deccan, but a beginning has also been made in Gujarát. The Department has a plot of land at Aslali in Ahmedabad District for demonstrating the value of green manure from paddy and incidentally it has been demonstrating the value of light iron ploughs, such as the Monsoon and the I.N.D. (both made by Messrs. Ransomes, Sims and Jefferies, Ipswich, England), for ploughing the paddy fields in order to bury the weed growth which springs up with the first rains. This has led to a brisk demand for such ploughs and the Department has recently opened a depôt for the sale of these at Aslali.

65. That a genuine demand for light iron ploughs has set in in north Gujarát is brought out by the following statement of sales during the year under report—all to *bona-fide* cultivators:—

Name of Plough.	Sale of—		
	Ploughs.	Shares.	Spare points of shares.
I. N. D.	20	24	.....
Monsoon	18	.....	43
B. T.	18	17	.....
Others	2	2	.....
Total ...	53	43	43

9.—SHOWS AND DEMONSTRATIONS.

No.	Place.	Date.
	Deccan.	
	Poona District—	
1	Dehu ...	...2nd March 1915.
	Nagar District—	
2	Nagar Farm ...	...27th October 1914.
3	Vadála ...	...29th October 1914.
4	Kolar ...	...10th January 1915.
5	Sangamner ...	...4th „ 1915.
6	Kharde ...	...28th „ 1915.
7	Madhi ...	...6th March 1915.
	Násik District—	
8	Nándgaon ...	...18th December 1914.
9	Naitale ...	..5th January 1915.
	West Khándesh—	
10	Dhulia Farm ...	...2nd Fortnight of September 1914.
11	Sárangkheda ...	...2nd December 1914.
12	Shirpur ...	...31st January 1915.
	East Khándesh—	
13	Kanalda ...	...11th October 1914.
14	Páchora ...	...17th „ 1914.
15	Bodwad ...	...25th „ 1914.
	Guzerát.	
	Surat District—	
16	Bulsár ...	...6th December 1914.
17	Mándvi ...	...21st „ 1914.
18	Walod ...	...22nd November 1914.
	Broach District—	
19	Amod ...	...28th „ 1914.
20	Ankleshwar ...	...6th February 1915.
	Kaira District—	
21	Borsad ...	...31st January 1915.
	Ahmedabad District—	
22	Modása ...	...8th November 1914.
23	Talod (with cattle show)	...22nd January 1915.

67. As noted in the margin, there were 23 organized shows and demonstrations conducted in the course of the year in addition to a large amount of informal work. The war somewhat interfered with this work and in a few cases shows were cancelled as the people were not in good heart owing to the difficulty they experienced in selling their cotton crop. In a few of these demonstrations the occasion extended over several days, when parties of cultivators from different tálukas were brought in daily. This was done at Dhulia and Asláli.

68. Plough demonstrations in cultivators' fields were carried on throughout the ploughing season by the kámdárs and store-keepers connected with the cotton operations in Khándesh.

69. Threshing demonstrations with the Olpád threshing machine were conducted in the marginally noted villages in the Tápti Valley.

1. Nizer.
2. Pathri.
3. Nandurbár.
4. Velda.
5. Kothale.
6. Shirpur.
7. Ajanda.
8. Dabiwad.
9. Amoda.
10. Dondiáchi.
11. Nimgol.

70. Gul making demonstrations were conducted on a large scale, as shown in the margin. The gul making demonstration at Sháháda proved very successful, and the people afterwards hired the services of a Departmental man for a month and half. These demonstrations proved particularly valuable on the Godávari Canal which has only been open for two or three years and where the local cultivators are very ignorant about sugarcane generally and gul making in particular. In the village of Pohegaon the people were delighted because the colour of their gul was so good and they were thereby enabled to obtain Rs. 20 to Rs. 22 per palla against Rs. 18 for the stuff made according to their own methods.

Name of District.	Name of Táluka.	Number of villages.	Number of furnaces built.
Násik ...	Dindori ...	12	50
	Niphád ...	3	6
	Násik ...	2	2
	Others ...	4	6
Nagar ...	Gadávari Canal ..	12	16
West Khándesh...	Sháháda ...	2	2
East Khándesh ...	Chálisgaon ...	1	1

71. On this canal steps were also taken to demonstrate the use of iron ploughs and the Poona method of planting cane, an aggregate area of 64 acres being thus planted. Arrangements are also being made to demonstrate the use of cake manure by arranging to supply it in the form of takávi loans, and also the extended use of green manuring through the Irrigation Department, which is offering reduced water-rates. The introduction of early maturing groundnuts is also receiving attention.

72. A number of temporary demonstration plots were managed by the Department in Khándesh and Guzerát in connection with the work of the local Agricultural Associations.

The points demonstrated in this way were:—

The superiority of N. R. cotton over the local mixture.

The value of Spanish peanuts.

The effectiveness of steeping jowár in copper sulphate to prevent smut disease.

The value of green manuring as a preparatory operation in paddy cultivation.

The latter demonstration was conducted on the plot rented by the Department at Asláli and it proved very impressive. The yield on the plot manured in this way amounted to 2,820 lbs. of grain, while the plot manured with 16 cart-loads of Farm yard manure gave an outturn of 2,272 lbs. of grain, while a third plot manured with 600 lbs. of castor cake per acre yielded at the rate of 2,584 lbs. of grain. As a result of this demonstration indents were received for 14,720 lbs. of sán seed.

73. Copper sulphate is now sold in one-anna packets with a description on the outside showing how the jowár seed is to be treated. The amount of copper sulphate in each packet is 2 ozs., which is enough to treat at least 5 lbs. of jowár seed—sufficient to sow one bigha of khárif jowár.

Name of District.	Number of packets distributed.
Ahmedabad	412
Broach	490
Surat	356
West Khándesh	200
Nagar	88
Poona	40
Násik	40
	1,626

In the year under report district overseers distributed large numbers of these packets, as noted in the margin. The Revenue Department is also popularising these packets. In this way over 3,000 packets were distributed in the southern division of East Khándesh.

10.—AGRICULTURAL ASSOCIATIONS AND CO-OPERATIVE SOCIETIES.

74. Experience shows that an Agricultural Association can do little unless it employs a trained man and even then rarely secures a hold on the people. A much more promising agency for introducing agricultural improvements is the Co-operative Society. The best of these Societies represent well organized bodies of cultivators and they have a real hold upon the members. When such a Society takes up an agricultural improvement there is a good chance of its reaching the right sort of people who will give it a full and fair trial. At Málegaon in Násik district some co-operative societies are doing excellent work by advancing seed supplied by the Department to their members instead of giving them cash, by investing a part of their funds in implements which are lent out on hire and by insisting on their members adopting certain approved measures, such as storing Farm yard manure in pits.

75. The District staff now make a practice of inspecting co-operative societies and render assistance in helping them to make purchases.

Arrangements have also been made to supply Agricultural Associations and Co-operative Societies with a trained man who can carry on their technical work. For this purpose Government have sanctioned the creation of five posts of non-graduate in training and two men have already been supplied to the Jálgaon and Bhusával Associations, while two more are now in training, one of whom is intended for the Dáregaon (Málegaon, district Násik) Co-operative Society. For these posts Vernacular speaking men of good physique are preferred, and they are put through a course of practical training before being handed over to the Societies. Their pay is Rs. 20 per mensem.

76. The following agricultural Associations came into existence in the course of the year :—

(1) Bulsár-Párdi in Surát District.
(2) Shirpur in West Khándesh.
(3) Chopda in East Khándesh.
(4) Bhusával in East Khándesh.
(5) Páthardi Mahál in Nagar District.
(6) Shevgaon in Nagar District.

11.—NEW WORK.

77. The two principal lines of new work taken up in the course of the year were :—

(1) The opening of an 100-acre Fodder Farm at Sávalvihir near Kopergaon.

(2) The organization of demonstration work upon the principal canal areas in the North Deccan, more particularly in connection with sugarcane, by the appointment of Mr. G. N. Sahasrabudhe, Sugarcane expert.

T. F. MAIN,
Deputy Director of Agriculture,
Northern Division, Poona.

APPENDIX D.

SUMMARY OF WORK DONE BY THE DEPUTY DIRECTOR OF AGRICULTURE, SOUTHERN DIVISION, DURING 1914-15.

Staff.—The staff has been increased by four men, three at the Vernacular Agricultural School at Devihosur, the Head Master, his Assistant, and a non-graduate field-man, and one man, a graduate in the Belgaum District. The last is stationed at Belgaum, and tours the whole of the district No other changes in the distribution of the District staff have been made. The two field-men in charge of the gardens at Dhárwár and at Gokák attended a special course in gardening, under the Economic Botanist at Poona. Other men as far as possible have been allowed to move about, to farms in the Southern Division and to Poona, for any special and appropriate study. The Cotton Supervisor tours more than he did formerly. He has taken up wheat breeding in addition to cotton breeding. The Divisional Inspectors' staffs have been mainly occupied with demonstrations, with various enquiries, with sales of manures, seed and implements, and with crop experiments. In addition three men in Sholápur and Sátára have experimental plots to manage. The Overseer at Bijápur supervises the Agricultural Association's garden.

The lease of the Bársi experimental plot expires this year, a new plot is to be taken.

General. The principal subjects for enquiry have been Cattle-breeding, Banding and Levelling as practised in various parts of the Southern Division, Rice cultivation, Fodder storage, and Cotton marketing.

Preliminary notes have been written on these. Some but not all have reached a stage sufficiently advanced for report. They are mentioned below under appropriate heads.

The question of wire-fencing against pig has been examined in detail. Unfortunately the extraordinary rise in the price of wire prevents the possibility of finding a cheap fence for the present. A note on fencing construction is ready for publication when the time becomes suitable.

Interesting Novelties were :—A demonstration extending over 10 days on the Dhárwár Farm, for which cultivators from all over the Southern Division were invited, the crushing of cultivators' sugar-cane on the power mill at the Gokák Canal Farm, the introduction of ploughing competitions in connection with Agricultural Demonstrations and the sale of young fruit trees. The terms for crushing cane were Rs. 1-6-0 per pan of gul. Cane was attracted from a radius of ½ a mile. Further details are published in the farm report.

Extension of the use of iron implements forms an important part of the Department's activities. The supply has been centralised at three depôts, who usually obtain their stock, on credit from Bombay firms, to be paid for as and when sold. Some stock is purchased for retail, and some is home-made. The depôts supply customers direct or advance stock to sub-depôts. Special accounts have bean introduced and are found to work satisfactorily. A small carpentary shop and smithy at Dhárwár supplies the depôts with wheat threshers and with a few other implements, and carries out repairs. Ploughs, wheat-threshers and levellers are kept for hire. Advertisement is effected by demonstration of implements at work, and through the Dhárwár Agricultural Association's magazine.

The total value of implements sold during the year was Rs. 6,000, an advance of Rs. 2,000 on the previous year's sales. Probably at least double this value would have been sold, had trade been normal. The success of organization outlined above depends primarily on the ability of Bombay firms to maintain an adequate supply. Fifty wheat-threshers could have been disposed of had the suppliers of iron discs not failed us.

Implements.

Lists have been compiled recording past and current results of experimental trials with implements. The Sabul plough, first shown at Sholápur by Messrs. Duncan Stratton and Co., in the year 1913, was brought to Dhárwár, tried and advertised; it is likely to become very popular. The clipper seed drill will probably be useful on experimental farms, but is too delicate for the cultivator. The McCormick Daisy reaper is likely to find scope in Bijápur and Sholápur. It was taken on hire for one month, but as the jowár crop lodged just before harvest, work was unsatisfactory and hire charges were not recovered. The Bajac plough has been sold for Rs. 1,800.

The Olpád wheat-thresher was in great demand. Several were manufactured locally. The following table shows the efficiency of the implement :—

Serial No.	Date of Experiment.	Method of threshing.	Quantity of straw threshed.	Time required.	Labour required.	Cost of labour.
			Lbs.	Hours. min.	Men. Boys. Cattle.	Rs.
1	1915	Local	2,500	5 15	2 0 20	6
2	Do.	Olpád	do.	2 30	2 0 2	1
3	1913	Local	5,000	6 0	2 1 13	16
4	Do.	Olpád	do.	6 0	2 1 2	1
5	1914	Local	do.	6 0	3 0 14	4
6	Do.	Olpád	do.	4 0	3 0 2	1
7	1915	Local	6 carts load.	12 0	3 0 16	5
8	Do.	Olpád	do.	6 0	3 0 2	1

The Chatanooga sugar-cane mill is likely to be in demand. A special advertisement of it has been issued.

Hiring out of implements, especially ploughs, has been most successful. With a little experience to show what implements are in demand, this business would be very paying. 17 per cent. gross income is rather a low figure, as depreciation charges will certainly be heavy. However with the right implement in the right place, profits would be high.

HIRE OF IMPLEMENTS.

Name of Depôt.	Capital cost.	Recoveries.	Current repairs.	Percentage recoveries on capital.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Dhárwár	199 7 3	40 10 0	...	29·9*
Gadag	216 4 3	13 3 0	0 12 0	6·0*
Bijápur	281 3 6	29 4 0	...	10·3*
Gadag Farm	313 15 3	51 5 0	7 3 4	16·3*
Gokák Farm	90 0 0	24 0 0	8 0 0	24·0*
Devi-hosur	195 15 2	20 8 0	10 4 0	9·9*
Sholápur and Sátára	654 0 0	180 7 0	.....	27·7†
Dhárwár Farm	2 4 9 9	21 0 0	.....	7·3*
Dhárwár Agricultural Association ...	273 0 0	41 10 6	7 2 6	15·2*
Belgaum	42 0 0	1 2 0	.....	4·2
	2,550 7 2	423 1 6	33 5 10	17%

Implements included are Gallows, C.T.1, Sabul, B.T.2, Arlington and Kirloskar's ploughs, wheat-thresher, Leveller and stone-roller.

* Various implements.

† Ploughs only—other implements worth Rs. 526 were not in demand.

The Agricultural Engineer is reporting separately on the steam-plough. Canvassing, Tagai-work, coal and water supply were arranged by the Agricultural Overseer on the Deputy Director's staff. A simpler method of drawing tagai in a lump sum was adopted. There is an overdraft of Rs. 3,545 which will be carried forward till next season; the steam-plough will pay interest in the mean time.

The work turned out is excellent. Land ploughed in 1913-1914 was generally cropped with cotton. No yield tests comparing ploughed and unploughed land were made, but opinions of many cultivators have been recorded. Increased yields are estimated in value at anything from 10 to 50 per cent., and sometimes at more than 50 per cent. Of 11 recorded rental values, two have not altered, as the land was previously let on long lease, one has increased 50 per cent., five have been approximately doubled, two slightly more than trebled, and one quadrupled.

SHOWS AND DEMONSTRATIONS.

A general invitation to visit the Dhárwár Farm was issued to cultivators in three Southern Division Districts. Twenty parties came during ten days. The general interest displayed in the farm work and especially in iron implements was remarkable. The Divisional Inspector, Southern Division, conducted 22 demonstrations and the Inspector of Agriculture, Sholápur, seventeen. These do not include a number of small impromptu demonstrations, done by officers during the course of a tour, or at special request. Gul boiling and ploughing were the principal subjects for demonstration.

COTTON.

An historical description of the department's work on cotton was written by the Cotton Supervisor and published in Bulletin No. 70 of 1915. The same officer and the Divisional Inspector, Southern Division, have examined cotton marketing in some detail. In connection with Government Resolution, No. 6232, dated 6th July 1914, Revenue Department, the conclusions drawn from these reports are that interference with the cotton markets beyond the standardisation of weights, and the supervision of weighments would not be justifiable,—that the extension of auction sale system would not be practicable.

Broach cotton did not flourish. The area sown was 2,500 acres; 1,500 less than last year. But the quantity of cotton received for auction was only 1274 Dokras weighing 314 Nagas of 1,344 lbs. each. Cambodia cotton worth Rs. 41,797 or double last year's quantity was sold by the Department.

Neglectum Roseum has almost certainly a future in Sholápur District. Six thousand pounds of seed were distributed. Yields were from 650 lbs. to 950 lbs. as a dry crop in six villages. The cotton also flourishes under irrigation. Its success is likely to depend on the possibility of producing seed supply locally.

Experimental work follows the same general scheme as heretofore. Various problems which have arisen through the introduction of Broach and Cambodia cottons are being investigated at Dhárwár and at Gadag. Pure line breeding is in some cases showing marked and definite progress. Christopher Culpepper cross is valued more highly than any other cotton grown at Gadag. Separation of boll types in Broach, and an examination in the variation of the ratio of lint to seed in single bolls are interesting new lines of research. Of the two types in Dhárwár American, New Orleans breeds practically true.

Jowar.

The position of the experimental work was briefly summarised in last year's report. During the coming season an extensive campaign against smut will be undertaken. 70,000 anna packets of copper sulphate are on order. Steeping was demonstrated in 75 villages of the Sholápur Districts, 17 of the Sátara District and in 21 tálukas in the Southern Division. Enquiries regarding threshing and winnowing machinery have led to nothing as yet.

Wheat.

New Bansi has been tried by cultivator at Nalawadi. It yielded about 170 lbs. per acre more than the local variety. Sket parner was tried at Aminbhavi and at Harobelvdi. The crop did well, but was not compared with the local wheat.

Sugarcane.

Manurial, cultural and varietal experiments are in progress on the Gokák Canal Farm. Various plots have been laid out in cultivators' fields in Sátára District to demonstrate the value of ammonium sulphate as a manure. 28 tons of ammonium sulphate were sold at Rs. 14-12-0 per cwt., 20 tons in Retra, district Sátára, alone. The supply fell short of the demand. Increase in demand in the Karád and Wálva Tálukas is shown by the following figures :—

Year.	Tons.	Cwt.
1913-1914	16	5
1914-1915	28	0
1915-1916	50	0
Estimate for 1916-1917 ...	100	0

This is largely the result of systematic and thorough advertisement.

Gul-boiling is dealt with elsewhere in this report. The Divisional Inspector, Southern Division, has recorded a description of varieties of cane occurring in the Mallad and of the conditions under which each is grown.

Rice.

Rice has uptill the present received very little attention in this division. A tour through the rice tract of North-west Dhárwár and South Belgaum has afforded material on which to base future work. A preliminary note will, it is hoped, be amplified and published shortly. Tillage implements are many and vary widely in design in different places. The work allotted to each implement is to be defined, and its efficiency described. The tools which are most inefficient are probably the plough and the Kodati, or wooden hammer. Two iron ploughs, one by Kirloskar Brothers and the W. K. S. by Ransom Sims Jeffries & Co., were compared. The Meston by Burn & Co., will also be tried. The very common practice of sowing a second crop after rice complicates the plough problem. An efficient tool for levelling fields is likely to find a market.

As far as soils are concerned the most interesting question is what constitutes the power to carry a second crop. Sub-soil water will undoubtedly account for this power in a great many cases, but not in all. The varieties sown are numerous, but it seems likely that in any one tract, those of economic importance are comparatively few, and that the rest are luxuries. Water supply, and consistency of soil will probably prove to be the most important factor in deciding on the variety to be grown. An awned variety—possibly several varieties—which does not produce well filled grains, and whose grain falls to the ground, as soon as mature, is an obnoxious weed, which the most elaborate precautions and remedies fail to circumvent entirely. The problem is one which could only be worked out on an experimental farm. The conditions under which transplantations of seedlings is adopted instead of drilling seed will be watched. A few fields of rice are to be sown at Tegur, in order to obtain first hand knowledge of its cultivation.

Groundnuts.

The Islámpur plot has yielded no results yet. 1,500 lbs. seed in husk were ordered from Japan at the special request of few men. The husk of this seed is thicker than that of varieties previously imported, and the crop was not damaged by the heavy rain.

The failure of the groundnut market will handicap the introduction of this crop in the Southern Division.

Other crops.

Call for no special remarks this year.

Distribution of seed and of fruit trees.

Thirteen seed depôts were opened by the Divisional Inspector, Southern Division, for the sale of cotton seed, groundnuts, potatoes and san. The total value of seed handled, including that sold by the Dhárwár Agricultural Association, was about Rs. 5,500.

471 mango grafts, 852 lemon trees and 134 others were sold.

Cultural, Rotational and Manurial experiments.

There is nothing to add to the results described last year.

Banding and Levelling.

Reclamation of land by banding is commonly practised in the drier parts of this division, and is certainly a most important operation in dry farming. Some embankments have levelling by water agency and accumulation of silt as their main objects, some aim chiefly at the concentration of water from a comparatively large catchment area on to a few acres. The one result involves the other, and all embankments more or less prevent erosion. The various schemes, and the numerous systems for controlling overflow water and for trapping silt afford an interesting study. There is no doubt that a great deal of money is wasted through the erection of bands without expert advice.

Live-stock at Tegur.

The stock on the Tegur Farm now number one stud bull, 24 cows, 2 heifers, 14 bull calves, and 21 cow calves. The history of these animals is recorded in a herd book on the card system. They were in fair condition throughout the year. Hay and silage were supplemented by a little oil-cake during the hot weather.

Expenditure on permanent improvement and on dead stock amounted to Rs. 900, and recurring expenses to Rs. 900. Clearing scrub, construction of two silo-pits and of a compound wall, were the most important improvements.

Hay and Silage.

Hay-making was fairly successful at Tegur,—cutting was done early enough—the interval between cutting and carting was too long; a few hours will probably be enough. With the help of the hay-rake recently imported, it should be practicable to shorten this interval considerably. Some varieties of grass are being compared on small plots. A large area of the farm has been manured.

Silage was made at Gokák from maize, and from sugarcane tops, at Tegur from grass. Pits are 10 feet in diameter and 10-12 feet deep; one at Tegur is built pacca, the other unbuilt. Results are insufficient as yet to commit any final opinion to paper. Some details will be found in the annual report of the Gokák Canal Farm for 1914-1915.

Agricultural Associations.

Associations at Dhárwár, Belgaum, Bijápur, Hungund, Kurtkoti and Athni are active. That at Belgaum devotes most of its energies and of its funds to a milch cattle show. Bijápur and Hungund each organised successful general shows—Kurtkoti attracted a very large crowd to a demonstration. The Athni Association is young and very promising.

Vernacular Agricultural School.

Devihosur.

Buildings.—A review of preliminaries to the opening of this school is unnecessary. The school building erected in commemoration of the late Sirdesai of Sirsangi, is a generous gift by the Lingayat Education Fund Committee. Land for the school farm has been given free of rent for ten years by Ráo Sáheb Chenabasappa Shetti. The students' quarters and the outhouses have been built at Government expense on land presented by the same gentleman and will accommodate 30 boys.

Staff.—The Head Master is a graduate of the Poona Agricultural College, and received post graduate training in Poona and in Dhárwár. He is assisted by a man who has had several years' experience in the Educational Department, and by an experienced fieldman from the Agricultural Department.

Curriculum.—A two years' course of instruction, board and lodging are given free of all cost to boys between the ages of 14 and 17 years, who have passed the Kanerese 5th standard. Other qualifications for admission will be found detailed in the School Hand Book, and in advertisements published from time to time in local papers. The course of instruction is designed to be of practical value to the boy who intends to become a farmer in after-life. More than half of the working hours are spent in the field. In the classe-room the student

receives an introduction to the sciences allied to his art. The curriculum also includes reading and writing, Arithmetic, Geography, Sanitation, Surveying Co-operation and Land-laws. Two or three hours in each week are devoted to carpentry. A work-shop fitted with Carpenters and Smiths' appliances and tools is to be constructed.

Students' work.—15 students attended the first year's course—two Bráhmins, 12 Lingáyats and one Shepherd. The majority were late in joining, one left on sick leave and did not return. 13 satisfied the examiners at the close of the second term—a copy of the examiners' report follows :—

"As desired by you we visited the Vernacular Agricultural School at Devihosur and examined the boys of the first year. The school was opened in May last and hence there were no second year's students. The number of students on the roll was 14 and all of them appeared for the examination: out of these 13 passed in the annual examination as will be seen from the accompanying result-sheet. In mathematics a few students fared badly but in all other subjects they did creditably well and especially so in practical Agriculture.

The answers in the Agriculture, Nature study and Geography were to the point and showed that the students had well grasped the general principles taught to them. The students handled and managed the implements as a cultivator does.

The general standard of teaching was quite up to the mark. In mathematics we suggest that Mental Arithmetic and Practice should be included as students would find these more useful in their after-life than Simple Interest and the Double rule of three.

We further wish to note that more attention should be paid to hand-writing and the students during their 2nd year's course should be well acquainted with letter-writing, including ordinary Rent and Lease notes, Mortgage and Sale-deeds, &c., and also with the Simple system of Book-keeping."

Finance.—Accounts for 1913-1914 and for 1914-1915 are published below. The school is indebted to the Sir Sasoon David Trust Fund for scholarships amounting to Rs. 750, and to Mr. K. Y. Patil of Tirlapur for a donation of Rs. 50 :—

Receipts.	Amount.			Expenditure.	Amount.		
	Rs.	a.	p.	*For 1913-1914.*	Rs.	a.	p.
Dhárwár Treasury ...	1,000	0	0	Cultivation charges	144	2	1
				Purchase of implements ...	121	5	11
				Do. of live-stock ...	220	0	0
				Boarding charges	152	8	0
				Miscellaneous office expenses .	12	0	0
				Purchase and repairs of furniture.	350	0	0
Total ...	1,000	0	0	Total ...	1,000	0	0
				For 1914-1915.			
Dhárwár Treasury	6,530	1	2	Boarding charges	1,500	0	0
Scholarships	750	0	0	Cultivation including food grains for live-stock.	1,250	0	0
Donation	50	0	0	Construction of a well ...	219	0	0
				Miscellaneous office expenses .	711	4	6
				Purchase of live-stock ...	465	0	0
				Petty construction	259	10	0
				Purchase of implements ...	292	0	0
				Apparatus and Chemicals ...	76	3	6
				Purchase and repairs of furniture.	75	0	0
				Purchase of books	23	10	0
				Students' tour	65	0	0
				Peon's uniform and belt ...	5	4	0
				Establishment pay	1,391	10	8
				Travelling allowance ...	134	10	0
				Telegram and service postage.	35	0	0
				Land assessment	26	12	6
				Balance on hand	800	0	0
Total ...	7,330	1	2	Total ...	7,330	1	2

N.B.—Food stuffs for Boarding and Live-stock for the next year worth Rs. 400 purchased at the end of the financial year have been included in the above account.

Farm.—The farm is in two blocks, 10 acres of black soil and five acres of red. It is partly divided into small plots for the cultivation of one of which each student is made responsible.

The remaining area demonstrates local crops, thorough cultivation, and successfully introduced varieties of crops. A few vegetables are grown. For garden work the school will depend on a neighbouring garden until a well has been constructed.

The boys are taken on tour once a year. This year their itinerary was :—Hubli (Workshop); Hulkoti, Gadag (Kalasapur cane crop), Kotumachigi (Agricultural Demonstration), Naregal (Gardens), Ron, Bádámi (Cholachagad Gardens), Bijápur, Mulwad Mungooli (Dona Valley), Dhárwár Farm. In addition they are allowed to visit any Agricultural Demonstrations held within convenient distance. The school also promises to become a centre for the activities of the Agricultural Department in the South of the Dhárwár District.

General.—The school has to fight an uphill course. No effort is being spared to attract the right class of the public, by newspaper advertisement, by canvassing and by advertisement at Agricultural meetings. A full complement of students for the first year was secured, though late. Several candidates applied too late and were asked to renew their applications next year.

To maintain boarding house discipline was not an easy task for the staff, but with a number of disciplined boys in the school, the task should, in future, be comparatively simple.

T. GILBERT,
Deputy Director of Agriculture, Southern Division.

APPENDIX E.

SUMMARY OF THE WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE IN SIND DURING 1914-15.

Season.—The principal features of the season were the unsteady nature of the inundation and the falling off, of the river Indus earlier than usual. Rainfall was by about the average except in the hilly portion of the Lárkána District where heavy downpours caused some floods. The cold weather was characterised by the absence of the usual frost.

Organization of the Department.—The work of the year under report has been the continuance of all the experimental and demonstration work done in the previous year. The experimental work is conducted on the following 4 experimental farms, *viz.*, Mirpurkhás, Sukkur, Lárkána and Landhi (Karáchi district). A detailed report dealing with the several experiments tried on each of the above farms is issued separately. A general line of the work done is given here below. It consists of:—

1. Rotation experiments.
2. Tillage and cultural experiments.
3. Cottons.
4. Food grains.
5. Fodder crops.
6. Bosi cultivation.
7. Garden crops and fruit culture.
8. Miscellaneous crops.
9. Implements.
10. Live stock and poultry breeding.
11. Shows and demonstrations and general district work.
12. Agricultural Education.
13. Note on "Ak" cultivation.
14. The Seed Farm.

1. Rotation Experiments.

In the 2 and 3-year permanent rotations practised on the Mirpurkhás and Sukkur Farms since 1908 1910, respectively, almost definite results have been obtained. The following is the plan of rotations:—

	2-year Rotation.		3-year Rotation.		
	1st year.	2nd year.	1st year.	2nd year.	3rd year.
Beginning of Year Adhaon.	Berseem ploughed in	Berseem seeded.	Berseem ploughed in	Berseem seeded.	Wheat.
Kharif ...	Cotton ...	Bájri or jowár.	Cotton ...	Fodder crops.	Bájri or jowár.
Rabi ...	Berseem ...	Berseem ..	Berseem ...	Wheat ...	Berseem.

It will be seen that Berseem or Egyptian clover (trifolium alexandrium) forms the main rotation crop for cottons and cereals and is sown regularly every year in cold weather. This enables the land to be cultivated intensively without impairing its fertility. A glance at the past reports of the Mirpurkhás and Sukkur farms will show that the land under this rotation has continued, all along, giving good crops of cottons and cereals.

On the Landhi farm which is devoted mainly to potato cultivation experiments, potatoes are rotated with legumes, such as groundnuts, vál, choula and cereals. Each rotation is carried out on two one-acre plots. The following is the plan of rotations:—

Series.	Plot No.	Area.	Crop.	Seed rate in lbs.	Remarks.
		A. g.		Lbs. husked.	
E.	1	1 0	(*a*) Groundnut	40	
			(*b*) Potatoes	900	
	2	1 0	(*a*) Maize	30	
			(*b*) Potatoes	900	
	3	1 0	(*a*) ½ Vál	25	
			½ Choula		
			(*b*) Potatoes	900	

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC

Series.	Plot No.	Area.	Crop.	Seed rate in lbs.	Remarks.
		A. g.		Lbs. husked.	
C.	1	1 0	(*a*) Groundnuts	40	
			(*b*) Potatoes	900	
		1 0	(*a*) ½ Jowári	30	
			½ Bájri		
			(*b*) Potatoes	900	
	3	1 0	(*a*) ½ Vál	25	
			½ Choula		
			(*b*) Potatoes	900	
	4	1 0	(*a*) Sunn ploughed in	25	
			(*b*) Potatoes	900	
	5	1 0	(*a*) Sunn ploughed in	25	
			(*b*) Potatoes	900	

(*a*) = Kharif. (*b*) = Rabi.

The experiments with these rotations are being continued. The potato crop of the year having been damaged by a fungoid disease (Fusariem Solani) the results obtained are not worth mentioning.

On the Lárkána Farm, the rotation practised with kharif jowárs is as follows :—

Plot No. E 3 jowár and Moth against Plot No. F 3 jowár alone.

Plot Nos. E 4, 5, and 6 and F 4, 5, and 6 alternating each year with cotton.

Plot Nos. E 7 and F 7 jowár and Bosi gram alternating each year. No reliable results of these experiments too were obtained in consequence of the failure of the Abro canal and owing to the presence of kalar patches in test plots. The general trend of the results however shows that it will not pay to grow jowár on the same land for 2 or 3 successive years without the land either getting any manure or the main crop of jowár rotating with any legume.

2. Tillage and Cultural Experiments.

At Lárkána this experiment is conducted in connection with Bosi wheat. The object is :—

(*a*) To increase the absorbing power of the soil for water by means of ploughings in hot weather, the usual practice among cultivators being that the lands intended for Bosi cultivation are never ploughed before flooding them.

(*b*) To minimize the loss of moisture by obtaining an earth mulch by means of frequent ploughings and interculture.

(*c*) To test the effect of fallow ploughings in hot weather.

Another tillage experiment carried out in the rice area of the farm, is to test the comparative advantages of fallow ploughings of rice plots in cold weather against unploughed plots.

These experiments are in progress and will be continued till some definite results are obtained.

On the Mirpurkhás and Landhi Farms the making of ridges with the ridging board attached to the plough has given excellent results. At Landhi where potato crop is sown on ridges, the cultivators spend about Rs. 10 to get one acre of land ridged up by manual labour. At the sowing season when the demand for labour is great everywhere, the sowing operations are considerably delayed for want of labour. Further the demand for labour being more than the supply the wages rise as high as rupee one a day per man. From the experiments carried out it has been found that one pair of average bullocks can ridge up 1 acre a day of 9 hours with about a couple of men following with a spade to repair and join them up.

Comparative trials on the Mirpurkhás Farm have proved that the ridge-grown cotton not only gives better results than the one sown on a flat ground but a considerable economy is effected in the quantity of the seed and water, not to speak of the hoeing charges which are reduced to one-half at least.

As a result of experiment and subsequent demonstration, some intelligent cotton growers have now begun to interculture their cotton fields by running the ploughs between the rows after the land has been softened by irrigation. This saves at least 2 costly hand hoeings and has been found to be very effective in keeping the field clean where the cotton has been sown in rows.

5.—Cottons.

Egyptian cotton.—Trials of three varieties of Egyptian cottons, *viz*; Abassi, Mit-Afifi and Assil are still continued on the Mirpurkhás Farm. They are more for educative purpose than for anything else as the irrigation facilities obtaining at present in Sind are not favourable to their successful growth.

The largest yield of 509 lbs. seed cotton per acre was obtained with Mit-Afifi a variety all along recognized to be the hardiest of the three. Abassi gave a yield of 449 lbs. seed cotton per acre. The crop in its early stage of growth was somewhat damaged by white ants.

American cotton experimental trials.—The following 8 varieties of American cottons were tried on the Msrpurkhás Farm during the year :—

1. Truimph.
2. Allens Long Stapled
3. Columbia.
4. Griffin.
5. Black Rattler.
6. Texas Big Boll.
7. Toole.
8. Peterkins.

Numbers 1 to 4 were sown by the 3rd week of March and the remaining 4 in the month of April to May. They all did well and the results obtained prove conclusively over again that its cultivation in Sind is successful. The following is the statement of results :—

Variety of American cotton.	Yield in lbs. per acre.	Value in Rs.	Cost of cultivation in Rs.
		Rs. a. p.	Rs. a. p.
Triumph	753	61 3 7	32 8 4
Allens	566	45 15 5	31 7 4
Columbia	496	40 4 10	26 8 4
Griffin	779	63 5 4	29 13 7
Black Rattler	833	67 10 10	35 14 1
Texas Big Boll	798	64 13 5	32 0 2
Toole	847	68 13 1	31 2 1

Toole stands topmost with regard to yield. It is yet doubtful whether it will keep on its yielding quality. Further trials will show this.

On the Sukkur Farm only, Allens Long Staple and Triumph were grown. The former yielded 332 lbs. seed cotton, and the latter 230 lbs. seed cotton per acre. The plots occupying these cottons contained large patches of kalar and consequently the crop was very patchy.

Cotton experiments in the district.—One thousand five hundred maunds of seed have been distributed as follows, for the coming season (1915-16) :—

Daulatpur	218	Nawábsháh	51
Mirpurkhás	101	Sukkur	3
Jamesabad	794	Lárkána	50
Digri	177	Upper Sind Frontier	25
Sinjhoro	75	Landhi	6

Besides 90 maunds of special seed obtained from the Seed Farm were distributed to the Honourable Mr. G. M. Bhurguri, Mr. Sahibsing and the Sind Reclamation Company with the condition that they would sow it separate from the other American cotton, and sell back the produce of seed to the department at market rate.

This together with the seed produced on the Seed Farm will be utilized for distribution next year.

Owing to the war and the consequent low rates prevailing for cotton, its cultivation has to some extent been replaced by cereals. The grantees on the Daulatpur minor have also substituted cereals for cotton.

The closure of some of the branches of the Jamrao Canal for clearance in March and April has further reduced American cotton cultivation.

During the year under report, 1,632 maunds of American cotton seed were distributed for about 2,500 acres.

In Lárkana district the crop was damaged on account of heavy floods.

In Upper Sind Frontier the crop failed for want of the necessary attention and care on the part of the growers. The district being not accustomed to cotton growing, the operations should have proceeded rather slowly.

In lower Sind the crop was on the whole satisfactory and gave promise for future success.

The amount of American cotton baled and exported from Sind was 550 bales of 400 lbs. each. This is an increase on the last year's export of this cotton and if this season had been more favourable the increase would have been still greater. About half of this quantity was bought by Messrs. Ralli Brothers, as the Sind American Cotton Syndicate delayed quoting their rates for the phutties unduly long.

Messrs. Greaves, Cotton and Co. offered Rs. 6-4-0 per maund of 41 seers of seed cotton for top lots. Sindhi cotton at that time was selling for Rs. 4 a maund of 41 seers. Towards the end of the season Rs. 7 per maund were offered, the rate for Sindhi cotton being a little over Rs. 4.

The quality of the cotton was all round good, though there was in many lots a good deal of mixture of Sindhi cotton which reduced the character of the staple considerably.

The produce of the Seed Farm cotton was saw-ginned on the Farm and was on comparison found to be much superior to the roller ginned. This points out the advantage of ginning all American cotton in a saw gin as is done in America. A sample of the Seed Farm cotton lint was sent to Liverpool and was classified as Strict Good Middling and value Fully Middling. This is indeed as satisfactory as could be expected.

Sindhi cotton.—On the Mirpurkhás Farm the trial of Sindhi cotton with selected seed is continued. The advantage of seed selection combined with careful cultivation can be clearly seen from the enhanced figures of yields obtained from year to year of its trial. The following statement shows the results of its trials during the year under report:—

Plot No.	Crop.	Yield in lbs. per acre.	Value in rupees.
			Rs. a. p.
C—1	Bhitshah cotton	1,285	76 8 9
C—11	Do.	809	48 2 1
C—13	Do.	461	27 7 5

Note.—The last plot has patches of kalar.

4.—Food Grains.

Jowárs and Bájri enter the 2 and 3-year permanent rotation scheme laid down a few years ago. The varieties of jowárs grown in lower Sind are Alakh of Northern Sind and Janapur of United Provinces. Both are white varieties and are the best of all jowár varieties grown in lower Sind. Presidency jowárs being late growers have been rejected.

The varieties of Bájri under trial are Nigerian, Awned, and local. Nigerian has deteriorated and is not likely to succeed unless a fresh seed is imported from time to time. Awned Bájri has the advantage of being less liable to the attack of birds and has so far proved equal in yield to the local.

On the Lárkána Farm a test of the several varieties of jowárs is in progress with a view to selecting the best kinds. Northern Sind is noted for the cultivation of best jowárs in the province. The climatic conditions being favourable they attain a size perhaps unknown in lower Sind.

Wheat.—The varieties of wheat under trial are the Pusa 9. A 2, Pusa 9-E-1, Pusa 12 selected Sindhi white, and Booji mauro. The last two are cultivated under irrigation on the Mirpurkhás Farm and as Bosi on the Lárkána Farm. Selected white Sindhi has continued giving satisfactory results and Pusa 12 has yielded 760 lbs. grain per acre. Booji mauro a variety from Baluchistan has also done well; one acre plot on the Sukkur Farm having yielded 1,000 lbs. of grain.

This year's wheat crops were however not normal as they were damaged by heavy rust on the Sukkur and Mirpurkhás Farms and suffered from drought on the Lárkána Farm owing to the unsteady inundation and the premature fall of the river.

The other wheats under trial are :—

1. Fundni.
2. Kahno.
3. Pissi.
4. Nagpur.
5. Shet Parner.
6. Lál Kasarwali.
7. Daudkháni.
8. Deshi Red.
9. Black seeded wheat.
10. American wheat (Piam Beri Jao) and the African wheats.

These are all under observation still and therefore call for no remark.

Rices.—Among the varietal tests of paddy carried out on the Lárkhána Farm, a variety of scented rice, locally called Sonahri has given the highest yield of 2,072 lbs. of unhusked

grain. Jajai another scented variety, has given the next best yield of 1,528 lbs. unhusked grain per acre. Intermediate and course varieties have not done so well owing probably to the occurrence of kalar patches in the plots.

Other experiments conducted in connection with rices are :—

1. To test comparative advantages of different cultural treatments given to rice lands in rabi season such as :—

(*a*) Fallow ploughings against unploughed plots.

(*b*) Taking "Dubari" pulse crops such as Matar and Fenegrick broadcasted in rice or gram soon after rice is harvested.

(*c*) Transplanting one seedling *versus* the local method of bunch transplanting.

(*d*) To determine the quantity of water needed by a normal paddy crop per acre.

(*e*) And testing the value of artificial manures in increasing the yields of rices per acre with profit.

The above experiments were laid down only two years ago and are of a nature requiring cumulative evidence of some years' results before any final conclusion can be arrived at. So far they have proceeded under abnormal conditions due to the unsatisfactory inundation and to the presence of kalar patches in the soil. The results obtained are given in the Annual Report of the Lárkhána Farm.

On the Sukkur Farm out of 3 acres sown with three varieties, *viz.*, Sathryoon (60 days) Sugdasi and Kangani rices, Sathryoon has given the highest yield of 1,120 lbs. grain in husk.

5.—Fodder Crops.

Among the pulses tried for hot weather fodder, Guár (cyamopsis psoraliolides), Vál (dolichas lab lab) and choula (vigna catiang) have given excellent results on the Landhi Farm. These grew very luxuriantly and gave two heavy cuttings of green fodder. Among the cereals grown for fodder, maize did the best. It occupied the land for less than two months only and hence three crops of it were taken in the course of the kharif season.

On the Mirpurkhás Farm, pulses such as Udid, Moth, Mung, Vál, Chaula and Velvet beans have continued to give satisfactory results as hot weather fodder crops.

White and Red English Clovers and Italian Rye grass tried for fodder crops do not seem to suit the climate. They die off in May owing to excessive heat.

Among the cold weather fodder crops grown under irrigation, Berseem (Egyptian clover) has proved unequalled in its results. Its value as a high class fodder crop and as a renovator of soil is now well recognized all over the province and is fast gaining in popularity. Cattle owners in and near towns prefer it to anything else and pay for one cutting from Rs. 10 to 15 per acre.

A large number of indents for the seed are received annually not only from Sind but from other parts of India also. The demand for the seed is at present more than the supply but it will probably be possible from the next year to meet most of the indents if not all from the produce of the Seed Farm.

During the year about 25 acres were sown with Berseem on the Mirpurkhás Farm, of which 4 acres were reserved for seed. The rest was either cut or given to cattle, and finally ploughed in for cotton. The plots sown in October gave as many as five cuttings.

On the Sukkur Farm, 18 plots were sown of which more than half were ploughed up early in February and March for sowing sugarcane and cottons. An average good plot fetched from Rs. 15 to 20 per acre a cutting. The whole yield of Berseem including the quantity given to the Farm cattle and the quantity made into hay has been estimated to be worth Rs. 710, thus indicating the financial success of the crop.

6.—Bosi Crop.

The system of artificially irrigating the land just before the close of the inundation season and conserving the soil moisture thereafter by frequent tillage till the sowing time (October and November) is called Bosi cultivation. The crop receives no irrigation after it has been sown. The experiments with Bosi cultivation are carried out on two series of plots on the Lárkhána Farm. One series is irrigated twice and the other only once.

Two varieties of wheats are grown each on duplicate plot with similarity of treatment and of manuring, etc.

The cultivation of land is done by improved tillage implements such as the Egyptian plough, iron clod crusher, and the chain and tooth harrows.

This experiment was laid out only two years ago. The results of the year under report though duly recorded in the Farm report are not worth mentioning here as owing to low

inundation and the premature fall of the river, one Bosi series received only one watering instead of two, and the other series could only be half irrigated.

7.—Garden crops and Fruit culture.

The cultivation of garden crops chiefly potatoes together with fruit culture is carried out chiefly on Landhi Farm with the object of:—

1. Finding out the most suitable rotation and profitable manuring for potatoes.
2. The best method of storing seed potatoes.
3. And to promote fruit culture.

Number one has been described briefly in this report under rotations and fully dealt with in the Landhi Farm report. With regard to the storage of potato seed a fairly definite result has been obtained. This has formed the subject of a bulletin (Bulletin No. 10), and it is briefly described below.

For some time past, complaints had arisen in the potato growing tract round about Karáchi about the potato seed getting rotten under the local method of storing it in gunny bags or under sand and thus compelling cultivators to buy every time imported seed at a price ruling always very high at the sowing time. A trial was accordingly made in the past season of storing potato seed in boxes of the same pattern as are used in the early potato districts in Britain.

The boxes are made of ordinary deal wood and cost about 4 annas each. Their dimensions are:—

2′ long 1′ broad and 7½″ high at the ends.

The results of the trial were as under:—

The average weight of seed potatoes put in each box was ...	6⅔ lbs.
The total weight of potatoes put in was	2,000 „

They were filled on 10th January 1914.

Potatoes were planted from the boxes on 10th June 1914.

Then the average weight in each box was	5 4/15 lbs.
The total weight of potatoes planted was	1,760 „
The loss therefore was	240 „

This is equal to 12 per cent. on the amount of seed potato stored in boxes.

The potatoes in the boxes are easily got at and inspected. Any potatoes found rotten were removed once a week. They sprout in the boxes and are planted direct from the boxes without breaking the sprouts.

Fruit Culture.—Among the several varieties of peaches under trial a variety from Saharanpur has proved to be the best both in yield and in quality.

Nagpur oranges budded on lemon stalks have continued giving good results.

Three varieties of grapes, *viz.*, Mexican Rasin, Gross Coleman and Black Hamburg have continued to give excellent results. The quality of the fruit is distinctly superior to the local varieties under cultivation in Sind gardens. The seedlings and cuttings of grape vines as well of other fruits are much in demand and are sold in large numbers every year.

A large collection of imported fruit trees are on trial on the Landhi Farm. These will be individually reported upon in due course.

8.—Miscellaneous Crops.

The minor crops such as oil seeds, fibres, pulses cultivated for comparative tests are mentioned in detail in the various farm reports.

The groundnut is one of the most valuable introductions and has given promising results on the light soil of the Landhi Farm.

Varieties of Tur pulse under trial on the Mirpurkhás Farm have likewise given satisfaction but do not seem to have much future in Sind as the majority of Sindhis are non-vegetarian.

Pundia variety of the sugarcane is being grown together with the 3 newly imported varieties from the Presidency.

9.—Implements.

The use in the Jamrao tract of the wooden Egyptian plough introduced by the Department is now well established. The rapidity, completeness and the ease with which it has replaced the Sindhi plough is simply astonishing. Not only are these ploughs now made in towns but every village carpenter has learnt to make it and is making it for sale.

An improvement in substituting a hard steel share for the original iron share of this plough has lately been carried out. The new share lasts longer and does not, when coming in contact with hidden roots, get so easily bent up. The price of the complete plough is Rs. 5.

Among other implements under observation and trial the following are recommended :—

	Rs.
Wooden scraper for levelling land	7
Norag or Threshing machine	40
Wallace's Nurbudda Reaping machine	255
Dutch wheel water lift for small lifts	465
Archimedian screw water lift	600
Noria water lift under 10 feet	375

10.—Live stock and Poultry Breeding.

The yearlings consisting of one bull calf and 3 heifers of the best Karáchi milch cattle purchased last year are being carefully reared on the Mirpurkhás Farm. They will be bred and their milking quality tested.

Fat tailed sheep (Dumba) imported from Baluchistan side and kept on the Mirpurkhás and Lárkhána Farms for breeding purposes are doing well.

The systematic breeding of imported fowls such as Bushire Turkeys and Assil game is receiving a good deal of attention. A number of coups have been provided to keep and breed the birds of different age and breed. They do not however seem to thrive so well in Upper Sind owing probably to extremes of temperature.

11.—Shows, Demonstrations and General District work.

The agricultural show designed to be held at Mirpurkhás was abandoned on account of the cotton crisis in the Jamrao tract.

An agricultural exhibition combined with a cattle show was held during the year on the Landhi Farm for the first time. The cattle show was in charge of the Civil Veterinary Department.

The show was attended by a large number of zemindárs and the Karáchi gentry and created a good deal of interest. The number of agricultural exhibits brought in by zemindárs was as high as 306. Prizes for the best samples were awarded by the District Local Board.

Another show with classes for zemindári produce (on the same line as Landhi show) was held on the Lárkhána Farm with equal success.

At the above shows, samples of produce from the various Government farms were on view. At the same time lectures on Agricultural matters were given and the use of various departmental implements demonstrated.

General District Work.

System of work.—A net work of sub-stations or demonstration plots has been set up with a view to demonstrate the successful results obtained on the Experimental Farms and thus bring home to cultivators the advantages of good cultivation and superior crops. The sub-stations consist of from 5 to 10 one acre plots each and are either taken on loan from zemindárs or rented. They are worked according to the local 'hari' system. Each group of sub-stations is in charge of an Agricultural Overseer who has his head quarters fixed in the centre of his beat.

Sub-stations.—The following sub-stations were worked during the year under report :—

1. Thariri Muhabát	Lárkána District.
2. Dádu	
3. Shikárpur	Upper Sind Frontier District.
4. Jacobabad	
5. Kandhakote	
6. Sinjhoro	Nawábsháh District.
7. Nawabsháh	
8. Nausháhro	

Owing to the short and unsteady nature of the inundation, most of the Upper Sind sub-stations suffered in common with private fields.

Thariri Muhabát.—Here one acre plot yielded 5½ maunds of American cotton (Triumph) and Bhitshah cotton (selected seed) produced 13 maunds 18 seers (a maund=82 lbs.) per acre. Bagdar jowar yield was 1,058 lbs. per acre.

Dádu.—Owing to the shortage of water and to the attack of boll-worm cottons practically failed. Bagdar jowár yielded 10 maunds grain per acre. Velvet beans and soy beans gave 8½ and 10 maunds each per acre respectively.

Shikárpur.—Here too, owing to late and poor inundation, cottons were sown as late as July, 25th. Inspite of this an acre plot gave 6 maunds of 'phutties' of American cotton.

Jacobabad.—Here only one acre was cropped with cotton. The plot being under the direct management of the zemindár was neglected owing to the fall in the price of cotton on account of the European War.

Sinjhoro.—On this sub-station only one acre was planted with American cotton. The yield was 6½ maunds.

Naushárro.—Here one acre plot gave 7 maunds of American cotton. The crop attracted a good deal of attention of the neighbouring zemindárs.

Nawábsháh.—This sub-station had a fairly good supply of water throughout the kharif season. American cotton gave a yield of 8 maunds per acre, much above the average yield of Sindhi cotton in the district. Selected Sindhi Bhitshah gave about the same yield too. Jowárs and bájri were somewhat poor due probably to the exhaustion of the soil by the rank growth of weeds encouraged by the previous year's heavy rains.

Tur came up very poor in the beginning but as soon as its roots struck deeper, the crop improved and put on a very luxuriant growth. It gave a yield of 35 maunds per acre.

Demonstration and other District work.—As usual the Agricultural Overseers toured extensively in their beat in cold weather with the object of holding demonstrations with improved ploughs, scrapers and other implements of practical utility. The inspection of American cotton cultivation in the district (about 4,000 acres) and the booking of orders for seeds was carried out by the Divisional Inspector of Agriculture and the staff. They also attended to the distribution of 1,700 maunds of American cotton seed for sowing in the ensuing kharif season.

As a further result of the work of the department in the successful demonstration of improved implements, the Egyptian plough has begun gaining round in Nawábsháh District also. A couple of large influential zemindárs in that district have during the course of the year opened workshops in their respective villages for the purpose of making these ploughs.

Another zemindár has put up two wooden screw lifts at Nawábsháh under the advice of this department. These lifts are reported to be doing good work.

One more zemindár at Shikárpur has purchased from the department a wooden hand screw lift and appears in every way to be satisfied with it.

12.—Agricultural Education.

The vernacular Agricultural school at Mirpurkhás has continued to do good work. During the year under report 10 boys were admitted in place of 9 boys passed out in October 1914. Most of the boys from the last year's batch are reported to be farming on their own or other lands.

The present lot are between 18 to 25 years of age and are able to read and write either Sindhi or Urdu. They have been drawn from the following districts :—

Hyderabad	...	...	...	2
Thar and Párkar	...	...	...	7
Sukkur	...	...	...	1

The course is a 12 months one and the curriculum practical, requiring at least half the working time being spent in the field work.

13.—Note on "Ak" (Calotropis procera) Cultivation.

Experimental trials made, in obedience to Government orders, with the cultivation of "Ak" in the jail gardens and on the experimental farms during the year under report and in the previous years have proved that "Ak" is not suited for cultivation. If sown in close rows to prevent lateral shooting the plant grows very stunted.

There does not, however, seem any necessity for cultivating it, as it grows wild in abundance on fallow and waste lands in certain parts of Sind. An ample supply of stem could thus be easily obtained for the extraction of fibre.

Past trials have shown that the extraction of fibre by hand on a large scale is, from the commercial point of view, too costly a process; and that unless we adopt some power decorticator for the separation of the fibre the undertaking cannot be a commercial success.

During the year under review a 5 lbs. sample of "Ak" stems was sent to the Imperial Institute, London, for the experimental extraction of the fibre by one of the fibre machinery makers, but, owing to the long time occupied in transit the stems became too dry to allow of the fibre being prepared from them.

It now becomes obvious that the experimental trials should be made with the fresh material on the spot with any suitable machine which may be already on the Indian market.

Enquiries in this connection are being made in consultation with the fibre expert to the Government of Bengal.

14.—The Seed Farm.

The new Seed Farm measuring 200 acres acquired last year was put into working order during the year under report. The preliminary operations such as laying out of plots, ploughing and levelling, for getting the land into a fit condition for cultivation continued upto June. The season having thus far advanced for kharif cultivation only a small area of about 70 acres was put under American cotton. This however did not do well as the land was foul not having received any appreciable amount of cultivation previous to the sowing of the crop.

The yield amounted to 200 maunds of seed cotton which was ginned on the farm by a saw gin.

The seed was partly utilized for sowing on the farm and partly distributed.

Out of the 175 acres sown with Berseem in the last cold weather, about 85 acres were kept for seed. The crop has since been harvested and will be threshed out by the power threshing machine. The rest of the crop was either given to cattle or sold green. The total amount realized from the sale amounted to Rs. 736-15-0.

During the present season (1915) 94 acres have been planted with cotton and the remaining area will be cropped with Berseem in the ensuing cold weather.

No separate report is issued for the Seed Farm as the subject matter is too small for a special report.

GUL MAHOMED,
Ag. Deputy Director of Agriculture, Sind.

APPENDIX F.

SUMMARY OF WORK DONE UNDER THE EXTRA DEPUTY DIRECTOR OF AGRICULTURE IN THE KONKAN, DURING 1914-15.

The season 1914-15 on the whole was good for Konkan.

Ratnagiri Farm.

2. Considerable work was done to make permanent improvements on the farm. The area is levelled, plotted and fenced round. Hay shed and cattle byres have been got ready. The farm store and servants' quarters are under construction.

Rice.

3. *Green-manuring.*—(The scheme is described in the last year's summary). The experiments so far have not shown any decided advantage except in one series where san and dhaincha were grown under irrigation in the month of May and transferred to rice fields a week before transplanting rice. It may be remembered that the distribution of rainfall does not suit the growing of green manuring crops. The question of control of water (artificial or rain water) is very important.

The increase due to green manure (raised on irrigation) of *dhaincha* is note-worthy. The net profit due to green-manuring after deducting the cost of raising dhaincha and ploughing it in is Rs. 11-6-6 per acre at Ratnágiri. At Alibág, however, no such increase was got in the year under report. In the year 1913-14 this farm had shown decided increase on account of *dhaincha* green-manuring.

In the kharif season if there is any chance for green-manure it is only on light well drained soils.

4. *Field Manures:*—At the Ratnágiri farm, oil cakes, fish manure, bone meal and salt were tried. All these have given increased yields. Bone meal though it shows highest increase is costly. Fish and *undi* cake are available and will be useful in the south Konkan. Salt has given good results.

At the Alibág farm, oil cakes, bone meal and fish have increased yields considerably. Fish and *karanj* cake available in the north Konkan show good promises. Salt did show appreciable increase at Alibág. The bulky field manures did not fulfil the expectations since these did not show any increase.

5. *Rab substitutes:*—At the Ratnágiri farm, *undi* cake, fish and ammonium sulphate were compared with local cowdung-rab. In every case ráb substitutes have given increased yields.

At the Alibág farm, *karanj* cake, fish and urine earth were compared with cowdung-ráb. Karanj cake and fish plots yielded more, while urine earth less, than cowdung-ráb.

It can therefore safely be said that ráb substitutes grow equally good seedlings and in the localities where ráb material is scarce, can supplement though not supplant rábbing. Rábbing and ráb substitutes should be practised in rotation. The plots rábbed one year may be manured with ráb substitutes next year and those which received ráb substitutes that year should be rábbed the next year.

6. *Spacing and number of seedlings:*—At the Ratnágiri farm, sixteen seedlings 12″ × 12″ were compared with four 9″ × 9″ apart. Four seedlings did better.

At the Alibág farm, the results are contradictory in the duplicates.

7. *Tillage:*—Tillage in the Konkan differs in many important respects from that in the Desh part and this point requires special investigation. In the year under report two plots were ploughed in the hot season and two were not disturbed. All the four plots were ploughed as usual in the rains and transplanted. Hot season ploughing did not show any increase as it did in the years 1912-13 and 1913-14.

8. *Varieties:*—A large number of rice varieties are being grown. The work is in progress.

9. *Seed selection:*—Ear to ear selection has given Rs. 9-2-0 per acre net profit over that of check plot and it is worth while for a farmer to select ears for seed rather than take it from a common heap. It is better if the selection is continued year after year.

The Agricultural Overseer, Kanára, distributed 600 lbs. of Rascadum paddy. He reports that on some of the fields (on makki lands) he got 2,000 lbs per acre from this seed.

Groundnut.

10. In the light soils of Konkan groundnut does well as one of the crops in the rotation. Our main work on this crop is at Bandhan where we work out varkas land problems.

In fairly fleshy soils late varieties as Pondicherry and Virginia are more profitable. On thin soils, early varieties as Spanish and Small Japan do better.

In the year under report 5,200 lbs. of groundnut seed was distributed.

San.

11. Twelve thousand one hundred and seventy-six lbs. of san seed was distributed. It is mostly sown for fibre in the Konkan.

Irrigated Crops.

12. *Onions.*—This has given up to 29,000 lbs. of bulbs per acre at Alibág where the use of fish and sulphate of potash as mannure has been found to pay. This crop brings in from Rs. 50 to 160 net profit per acre. In the Konkan this crop is gaining popularity and fairly large areas (especially in the north Kanara) are put under onions. In the year under report seed was distributed through the Agricultural Overseer, Kanára, and also through the Secretary, Kumta Agricultural Association. On the cultivators' farms the yield at Kumta was up to 17,000 lbs. an acre.

13. *Sugarcane.*—Red Mauritius is gaining popularity in Kanára. The Agricultural Overseer reports that he distributed 30,000 sets. Several farmers besides have secured sets from others whom we supplied last year.

14. *Chillies.*—Chillies did well at Ratnágiri farm. The value of outturn in the case of local chillies was Rs. 371-8-3 in one case and Rs. 392-13-0 in the other, leaving a net profit of Rs. 131 to 134 per acre.

15. *Potatoes.*—It is not a financially successful crop yet. Trials will be continued changing seasons.

16. *Fodder crops.*—Lucerne did well at Ratnágiri giving 18,347 lbs. of green fodder in two cuttings per acre. It was unfortunately sown late and so it did not pay. Maize did poorly at Ratnágiri. Maize, berseem and lucerne did well at Alibág.

Work on varkas land.

17. The question of varkas cultivation in the Konkan is very important. The land is opened for taking the crops of nagli, vari, etc. But since it is not protected, it is washed by the heavy rains of the Konkan and left poor. To prevent this surface wash and to build its fertility the first thing necessary is to enclose small plots by bánds and keep them in repairs. Suitable rotation is another important thing. This work is in progress at Bandhan and it promises well.

District Work.

18. It is fairly well organized though due to the topography of the Division the staff is found inadequate. The Agricultural Overseers give demonstrations, distribute seeds, implements and manures and also advise the rayat.

19. A large number of demonstrations were given in ploughing with the Meston plough and as a result 74 ploughs were sold on requisition. Similarly gul making was demonstrated and Poona furnaces built for many. Six Poona pans were supplied during the year under report. Itinerant work of the Agricultural Overseers is appreciated by the Konkan public.

20. The leaflets and Shetki and Shetkari magazines supplied by the Director of Agriculture were distributed in the Division and the importance of their contents brought to the notice of literate rayats. As a result there is a larger demand for these. From this Division 53 people became subscribers to the Shetki and Shetkari through this office in the year under report.

Agricultural Associations and Agricultural shows.

21. Associations did not attempt agricultural shows as the minds of the people were distracted on account of the war. The Kolába District Agricultural Association has opened a small agricultural reading room and has stocked some useful books on Agriculture and Co-operation. They also sent one of their members to learn budding and grafting at Poona and Bassein for some months. The Panwel Agricultural Association gave a few field demonstrations and showed the work of the Meston plough. They have also stocked a few improved implements for sale. The Association at Sirsi distributed sets of Red Mauritius sugarcane and grew several varieties of rice on a small demonstration plot. They intend to purchase one sugarcane mill (iron) and two Poona type pans for popularising improvements in gul making. As usual the Associations at Kumta and Honáwar took a great deal of interest in the improvement of agriculture. Rao Saheb Basrur is doing very good work at his farm at Honáwar and also outside. The help of Rao Sahebs Basrur and Masur is found very useful to push improvements in Kanara. Mr. Babasaheb Gaokar of Masure in Malwan táluka always helped us by arranging demonstrations and supplying agricultural information asked for.

Distribution of Seed and Implements, etc

22. The following quantities of san and groundnut seeds were distributed :—

District where distributed.	Quantity distributed.	
	San.	Groundnut.
	Lbs.	Lbs.
Thána	1,028	1,000
Kolába	2,296	900
Ratnágiri	7,052	2,500
Kanara	1,800	800
Total ...	12,176	5,200

23. The following implements were distributed :—

Kind of implement.	Number sold.
Meston ploughs, complete ...	... 74
Spare shares	... 34
W. K S. Indian wooden ploughs ...	... 6
Chaff cutter	... 1
American Road Scraper (iron levellers)	... 2
Gul pans	... 6
Iron mills	... 1
Surti hand gin	... 1
Groundnut sowing—hand marker ...	... 1

24. Minor distribution :—

Name of seed.	Quantity distributed.
	Lbs.
Potato seed	1,024
Coconut seedlings	1,500 number of seedlings.
Red Mauritius sugarcane sets	30,000 do. sets.
Deep water paddy from Bengal	1,000

Besides, seeds of English vegetables as cabbage knol-kohl, radish, tomatoes, also onion, maize, guinea grass, wál, etc.; were distributed.

25. The following quantities of denaturalised salt were distributed :—

District where distributed.	Quantity supplied.
	Maunds.
Thána	125
Ratnágiri	1,203
Kanára	1,172
Kolába	78
Total ...	2,578

26. The following quantities of manures were distributed :—

Kind of manure.	Quantity distributed.
	Lbs.
Potasium sulphate	20
Ammonium sulphate	376
Fish manure	1,120
Safflower cake	400

P. C. PATIL,
Extra Deputy Director of Agriculture, Konkan Division.

APPENDIX G.

SUMMARY OF WORK DONE UNDER THE PROFESSOR OF AGRICULTURE, POONA, DURING 1914-15.

In addition to being responsible for the teaching of the agricultural branch at the College, I had the following Agricultural stations, which are more or less adjuncts of the College, in my charge :—

Name of station.	Area.	Rainfall.		Objects.
		Average.	1914-15	
	A. g.			
Agricultural College Farm ...	143 16	27·23	30·73	Chiefly educational; also as a central demonstration station and implement depôt.
Mánjri Agricultural Station ...	62 10	20·92	24·81	Sugarcane experimental and demonstrational station.
Agricultural College Dairy ...	353 19 (including 277 acres and 30 gunthas of Mánjri Kuráns).	27·23	30·73	Educational; supply of pure milk.

2. From the columns of rainfall above, it will be seen that this year's precipitation was heavier than normal at all the stations. On the college farm the heavy falls from mid July to mid August damaged the kharif crops, especially bájri, jowár and cotton. There were no rabi rains; but good outturns of rabi crops were obtained on the conserved moisture from the kharif season. On the Mánjri farm, the rainfall was favourable for sugarcane.

AGRICULTURAL COLLEGE FARM, POONA.

3. The work done at this station during the year was conducted on the same general lines as those in previous years. It can be summarised under the following heads :—

I.—Instruction.

II.—Experimentation and research.

III.—Dissemination of agricultuaral information and improvement, and general aid to the public.

I.—Instruction.

4. During the year every attention was given to the instructional work of the students, which is the chief aim with which the farm was started, rightly claimed the major portion of the area and the attention of the staff. Every care was taken to give practical demonstrations and practice to the students in the working of different implements, indigenous as well as introduced, and in the growing of all the main crops as well as in the methods of crop production in vogue in different parts of the Presidency. The students had the advantage of individual attention of the teacher in all possible cases. Besides the regular students of the college, the farm also undertook to give training to occasional students who came for short periods for receiving instruction in specialised subjects. During the year, four such students had come for the study of adjustment and working of improved agricultural implements and appliances. The District agricultural overseers of the southern and central divisions of the Department were also deputed to the farm to study the large stock of implements and appliances and the methods of work in vogue on the farm.

II.—Experimentation and Research.

5. The experiments carried on during the year were of the same nature as those in the preceding year, with the exception of some that were newly taken up. The following are the important and useful results arrived at.

Cotton.

6. *Varietal experiments.*—The experiments during the year conclusively prove that the yellow flowered neglectum cottons are quite unsuited to the Poona tract in point of money returns when compared with the white flowered neglectum varieties. Amongst the latter, Rosea (N. R.) has shown better return than Cutchica, a result contrary to that of the last year.

Amongst the long stapled cottons, Broach has again held its first place and in point of profits competes with N. R. It can be said that Broach can thrive very well and prove a more paying variety than N. R. in deep retentive soils of the Deccan under good management, but cannot be recommended in place of Varádi (N. R.) in the shallower soils. Cambodia has again shown its deteriorating character under climatic conditions available in Poona. Bhuri has as usual fared better than Cambodia.

Improvement of the quality of cotton seed for sowing by the gravity method of separation.—The method described in bulletin No. 53 of 1912 was found all along to be more efficient when used for Dhárwár-American cotton seed than for the neglectum types. During the year the height of the flue was reduced from three to two feet and the machine was tried for neglectum cotton. The results obtained were more satisfactory and showed an increase of 34 per cent. in outturn over the plot sown with unseparated seed. The cost of separation was only about 2 annas per acre. The method is worth recommending amongst the cotton seed growers.

Jowár.

7. *Varietal experiment.*—Gudghi has been the earliest to mature, requiring only four months for its complete growth. Perio stood first in point of yield of fodder and grain; and from the results so far arrived at, can be recommended as the best variety of kharif jowárs to be grown in tracts having a deep retentive soil and about 30 inches rainfall.

Fodder varieties of jowár.—Four principal fodder varieties were under observation—Nilwa, Utavali, Sundhia and Sorghum. Of these Sorghum yielded the most, giving 11,875 lbs. of dry kadbi and 890 lbs. of grain per acre. It also matures early.

Groundnut.

8. The results of the last three years' experiments have consistently proved that when groundnut has to depend on rainfall alone on fair descriptions of soil and with average rainfall of about 25 to 30 inches, it is more profitable to cultivate small Japan than the Poona local.

The comparison of the newly detected Big Erect variety with Pondicherry, so long the best of all the exotic spreading varieties, has shown the Big Erect to be superior to the latter in point of yield.

The manurial experiments with groundnut show that this crop does respond to an application of potash and that when superphosphate is added to potash there is a marked depression in the yield. Five cart-loads of farm yard manure still holds its place as more profitable than any of the artificials used, either alone or in combination.

Other Crops.

9. *Potato.*—A very interesting experiment was undertaken this year to see whether time of planting had anything to do with the appearance of Rhizoctonia, either by the changes in the climate from fortnight to fortnight or in the moisture content in the soil. But since the attack of Rhizoctonia was only very slight on the farm area this year, the experiment has not been able to give us any data with respect to Rhizoctonia. But if the times of planting rabi potato is considered alone, the period between the 2nd fortnight of October to 2nd fortnight of November seems to be better than either earlier or later.

10. *Gram.*—Two varieties, the brown (the local variety) and the white (Kabuli), were tried. The former has stood superior to the latter in yield and is moreover earlier by about a month. But in the Poona bazar, the latter which is largely used as parched grain, fetches a very high value of Rs. 22 as against Rs. 14 per palla of 300 lbs. for the local brown variety, and proves in the end more profitable than the brown.

11. *Linseed.*—Phosphoric acid in the form of superphosphate has proved of no benefit to linseed and has depressed the yield to some extent.

12. *Onions.*—A very striking result has been obtained in the manurial experiments with onion. It has been found that replacing 24 cart-loads of farm yard manure either by sulphate of ammonia or nitrate of soda, supplying 75 lbs. of nitrogen per acre, increased the yield on an average by about 8,500 lbs. of bulbs per acre, over that of the plot manured with 48 cart-loads of farm yard manure; and thus left a net profit of Rs. 56 per acre, when farm yard manure was sold at Rs. 2 per cart-load.

13. *Chillies.*—This crop has failed to show any beneficial response to an application of potash in addition to 12 cart-loads of farm yard manure.

Rotations and mixtures.

14. (1) *Continuous, mixed and rotation cropping.*—Bájri is the crop selected for this purpose and subordinate crops for mixing and rotation are pulses in the proportion of 3 : 1. The results so far obtained tend to show that taking a mixture of bájri and subordinate pulse crops is more profitable than growing bájri alone, in a continuous cropping of bájri. A continuous cropping of bájri with mixtures is also more profitable than having bájri and subordinate crops in rotation, in the proportion of the areas occupied by the two in the mixture.

15. (2) *Kharif fallowing vs. double cropping for rabi dry wheat under seasonal conditions similar to Poona.*—It has been observed with a dry crop of wheat that it is better to take two crops in a year than to fallow the land in the previous kharif season. Sán, when harvested for fodder, being a leguminous crop, has increased the outturn of the following wheat crop over that following maize similarly harvested.

16. (3) *The best crops to mix with Broach cotton.*—Spanish peanut, the early and erect variety of groundnut, is superior to either sesamum or rice or to growing the crop alone.

Manure experiments.

17. *Value of nitrate of soda on dry crops of cotton and jowar.*—Experiments in determining the value of nitrate of soda on dry crops have been instituted on this farm, on behalf of the Chillian Nitrate Prapoganda of Calcutta, since the year under report. They were advised to restrict the cost of any manurial treatment of dry crops to Rs. 15 per acre. The scheme, which is drawn up by them in consultation with the Professor of Agriculture, consists in giving nitrate of soda, either alone, in combination with a less available nitrogen in the form of cake, or also in combination with other elements of plant food. Varádi cotton and kharif jowar are the crops selected.

The results with kharif jowar do not show any consistency, and as a whole do not show any benefit due to nitrate of soda or other artificials.

In the case of cotton, however, the results are more encouraging. In general, the additional manures have increased the outturn to such an extent as to ultimately pay out their cost with normal prices of cotton, though the very low prices current have not been able to do so this year. Nitrate of soda alone has increased the outturn slightly, the increase being more marked when accompanied by farm yard manure. It is better to combine organic nitrogen, in the form of cake, than to give all the nitrogen in the mineral form When nitrate of soda is supplemented by phosphoric acid within the cost of Rs. 15 per acre, the outturn is increased, but in this case the results are more marked when the artificials are accompanied by farm yard manure than when not so accompanied. Addition of potash has not shown any benefit.

18. *Green manure experiments.*—Green manuring was tried with irrigated and dry rabi crops. Wheat was the crop selected. In the case of the irrigated series, sán was used for green manuring and compared with a plot receiving ten cart-loads of farm yard manure. The outturn of wheat on the green manured plot was not as much as on the farm yard manured plot; but when farm yard manure is not available for less than Rs. 2 per cart, sán green manuring, which costs less, has been found to be ultimately profitable. These results are in confirmation of those of the previous year.

In the case of the dry series, three kinds of green manure crops—sán, nigerseed and maize—are compared amongst themselves and with a kharif fallow plot which does not receive any manure at all. The object in comparing the three crops is to find out to what the effect of green manure is due. All the three green manured plots have given more outturn than the unmanured fallow. Nigerseed is however the best of all.

Dry-farming.

19. Two principles of dry farming—wider spacing and good interculture—have been made the points of investigation. As rabi season crops require the application of dry farming principles more than the kharif, under the climatic conditions at Poona rabi jowar and linseed were the crops selected.

The experiments with rabi jowar have shown that during this year of insufficient rabi rains, it is more advantageous to sow this crop at 18″ distance than 9″. Similarly, extra good interculture at an extra cost of Rs. 2-10-0 has increased the profits by Rs. 6-12-0 over the ordinarily intercultured plot. Both these results are quite in agreement with those obtained last year, when the rabi season was similar. In the year 1912-13, however, when the rabi rains were quite favourable the smaller distance was more profitable. This shows that the distance of the drill will have to be changed according to the nature of the season. As it is not, however, possible with our present knowledge to correctly prophesy the nature of the season at the time of sowing, the frequency of a particular nature of the season in a particular locality in the past years can be the only guide. Interculture can however be easily adjusted according to the season.

In the case of linseed wider spacing of 18″ did not show any advantage over 9″.

Eradication of Weeds.

20. *Experiments with regard to eradication of lavala* (Cyperus rotundus).—It has been found that frequent harrowing of the infested land, if possible once in every four days, will prevent any putting forth of leaves, and will gradually starve out the plant. In order to completely eradicate the persistent weed by the above process the operations have to be continued for two years. Although this process would entail some expense during its conduct, yet it can be expected to pay back its cost, and much more, by a larger outturn of the crop that might be obtained on the area in the future years.

New crops.

21. *Cabbage.*—Among the varieties tried during the year, early drum head yielded the highest, though its heads were not dense.

Cauliflower.—The snow ball variety did very well on this farm. The outturn was 13,366 lbs. of flower heads and fetched Rs. 484 at a cost of Rs. 230 per acre.

Chillies.—The big chillies from Dhárwár which are used for vegetables gave a good yield and fetched a good price.

Implements.

22. *New type of S. A. E. gallows plough.*—This is a modification of the old type of Ransomes' plough of the same name, differing from the latter in having a bend in the beam which enables all the bullocks to walk on unploughed land instead of in the previous furrow.

Disc harrow.—This implement was found during the year to be very useful in preparing the light mál land for sowing. Two turns of the disc crossways prepared a fine seed bed, about four to five inches deep, and thus proved superior to the ordinary harrow.

Sack-holder.—A simple and efficient sack-holder was devised during the year and proved very satisfactory. It is cheap, costing about Rs. 3 only, and is easy of adjustment and can be prepared by any village blacksmith.

III.—Dissemination of agricultural knowledge and improvement and general aid to the agricultural public.

23. This formed as usual a necessary sequel to the importance and position of the farm at the central agricultural station in the Presidency. Alongside of the education of the students of the Agricultural College, the farm had, therefore, to attend to the spread of agricultural knowledge amongst the agricultural public in general and to the supply of necessary aid and information regarding various points.

24. *Demonstrations.*—The farm is always on demonstration with its large collection of almost all the useful agricultural implements and appliances, which are shown in actual operation whenever desired by any of the visitors.

Special demonstrations were arranged on the farm on two occasions: one of these was specially organised for the cultivators from Sátára, Poona, Ahmednagar and Sholápur districts. This lasted over 21 days and in all about 1,000 cultivators took advantage of this. The second was arranged in December for two days in connection with the Maratha Conference.

The farm was also called upon to conduct the demonstrations in connection with the rural meetings held by the Deccan Agricultural Association at different places.

Implement, manure and seed Depôt.

25. This branch of the farm work has been the most appreciated by the agriculturists and maintained its usual popularity during the year under report. In all, implements worth Rs. 26,000 were sold and chiefly consisted of ploughs, spare parts of ploughs, plough chains, levellers, hand-hoes and others.

The farm also supplied seeds of various kinds, as far as the demand could be met from the farm produce. In all 23,534 lbs. of seeds were sold and principally consisted of groundnut fodder crops, vegetable seeds and others.

A small stock of artificial manures, which the farmers find it difficult to get whenever necessary, was also kept. The manure most in demand is sulphate of ammonia.

MANJRI FARM.

Sugarcane.

Rotation Experiments.

26. Experience has proved that the following rotation is suitable for successful cane cultivation in the Mutha valley and is therefore being followed on the Mánjri Farm :—

1st year	...	...	Sugarcane.
2nd „	...	...	Nilwa for fodder.
3rd „	...	...	Groundnut (early variety).
4th „	...	...	Sugarcane.

In this rotation sugarcane is given the usual heavy manuring and the following two crops are grown on the residual manure only. Both these are grown on rainfall alone and thus the land is able to recoup its original condition. The chief reasons for following this rotation are :—

(1) Nilwa jowar comes well after sugarcane and supplies a good folder for the cattle.

(2) Groundnut being a leguminous crop leaves the soil richer in nitrogen. Besides, it leaves the land in good condition as the soil requires a good deal of handling at the time of harvesting. Early varieties, such as Spanish peanut and Small Japan, should only be chosen so that there will be sufficient time to give preparatory tillage to the sugarcane crop for planting at the proper time (December and January).

(3) There is practically very little damage done to sugarcane crop by the borers as they are almost starved for not getting young sugarcane or jowar plants to feed upon. If Nilwa fodder is taken previous to the cane crop, all the borers which hibernate in the stubbles directly attack the cane plants as soon as they come out in the hot weather.

During the year turmeric was tried along with groundnut as a previous crop to sugarcane, since this practice is in vogue among the cane growers of the Sátára district. The results obtained show that turmeric being an eight months' crop is required to be planted in May, when water is very scarce on this side. Moreover, turmeric if planted in May matures in January and thus does not leave sufficient time for the preparatory tillage to enable the planting of cane to be done in proper time.

Manure Experiments.

27. Experiments for the past many years on the Mánjri Farm have proved that the most economical top-dressing for sugarcane is a combination of safflower cake and sulphate of ammonia (supplying 75 lbs. nitrogen in each case) in addition to 30 cart-loads of farm yard manure per acre.

28. During the year the *sán* green manured plot received no additional farm yard manure as was done in previous years. The results show that *sán* can be entirely depended upon for furnishing the coarse manure required for sugarcane. The *sán* plot gave 1,200 lbs. of gul (worth Rs. 86) more per acre than the check plot. To this may be added the saving caused by non-application of farm yard manure valued at Rs. 43 (Rs. 60 the cost of farm yard manure *minus* Rs. 17 the cost of green manuring), thus showing a gain of Rs. 129 over the check plot. Deducting from this Rs. 53 as net profit of growing groundnut in the previous year, green manuring of *sán* leaves a net gain of Rs. 76 over farm yard manure.

29. Trash (Páchat) has again proved to be a good substitute for farm yard manure, especially in places where the latter is getting dearer and dearer. It has been found that the quantity of trash obtained from one acre of sugarcane is quite sufficient for one acre of new cane, provided none of it is used for fuel. By the use of improved furnaces at least half the quantity of trash can be conveniently saved.

30. Nitrolim, a new manure containing about 18 per cent. nitrogen, was tried, with the result that it has not been found in any way equal to the standard dressing, but has been found to be better than castor cake (the cultivators' usual manure).

Methods of planting.

31. (*a*) *New method of planting.*—This consists in planting cane five feet apart in continuous rows as long as the contour of the land permits. Last year, on the farm the length of the row was over 400 feet. The number of sets used was as usual (18,000 sets) per acre. In this method the manual labour can be considerably saved by bullock labour. When the cane is planted according to the local method, the removal of weeds has to be done entirely by hand, but in this method it can be done by working a single bullock hoe between the rows, as often as necessary. This operation in addition to the removal of surface weeds and keeping under control the perennial weeds like Lavala (Cyperus rotundus) and Hariali (Cynodon dactylon) leaves a good mulch on the surface which helps in the conservation of moisture. Earthing up of cane, which is usually done by hand labour, can also be done within ¼th of the usual cost by means of the Sabul plough with an additional tail-sheet. Full details regarding the earthing up of cane with this plough have been given in leaflet No. 8 of 1914. Besides, there are several minor advantages such as easy and more efficient application of top-dressing and uniform watering. This method was tried in a big block of six acres on the Mánjri farm, which gave an outturn of 12,000 lbs. of gul per acre, which is above the average by about 2,000 lbs.

Being convinced of the above good results some of the neighbouring cultivators as well as some from Sholápur and Nira valley have planted a few acres of cane according to this method. The Irrigation Department is also taking a good deal of interest in this new method of cultivating cane. It is hoped that this new method will become a common method in the near future in canal areas.

32. (*b*) *Reduction in the number of sets.*—An experiment was undertaken to see whether any reduction could be made in the number of sets that are used at present for planting. Accordingly a plot was planted with half the usual seed-rate, *i. e.*, 9,000 sets, by placing the sets carefully so as to keep the eye-buds on the sides, with the result that it gave 1,000 lbs. of gul (worth Rs. 70) more than the other plot planted with 18,000 sets. Experiments to further reduce the number of sets are in progress. It is recommended that the upper half of the canes should be used for planting as (1) it contains a larger number of eye-buds, (2) it contains readily available food, and (3) it is poorer in sugar.

33. (*c*) *Java method of planting.*—The Java method of planting introduced by Mr. Keatinge has given promising results during the year. This method is specially suitable for deep moisture holding soils and where water supply is limited. The cane sets were planted in trenches 5 feet apart, which were 2 feet wide and 10 inches deep. Cross channels at every 30 feet were made to facilitate splashing of water. Water was given by splashing till the setting in of the monsoon, when the whole field was made level. After this no artificial irrigation was given till it was harvested in March. The object of this method is to utilise the moisture conserved by such soils and thus to take a crop of cane on a minimum amount of additional water. The first ratoon as it stands at present promises to give good results.

Season experiments.

34. These consist in planting cane every fortnight throughout the whole year to see the best time for planting, so that the cane will get sufficient time for its growth and give the maximum yield. Besides, it has been found that early planted cane is sufficiently strong to resist the attack of the borer just at the time when the moths emerge (March). The results so far obtained go to show that the season has more to do with ripeness of cane than the age.

Cane varieties.

35. Out of the foreign varieties brought from Sámalkota in the year 1909 and since then grown on the Mánjri Farm, B 208, B 376 and J 36 have been found to be equally rich as the local variety Pundia and these have been now grown on the field scale for the coming year.

Mills.

36. During the year several mills were given a trial on the Mánjri Farm. Out of the bullock mills, Chatanooga mill No. 23 seems to be a better substitute for the Poona mill in point of extraction, durability and finish, although it is a little more costly than the latter. But this extra cost could be very easily recouped in one year owing to 2 per cent. higher extraction given by the Chatanooga mill. Hatti mill gives a good extraction and seems to be a suitable one for introduction in tracts where thin canes in small and isolated patches are grown.

37. Chatanooga power mill No. 44 has been found to be suitable to cane growers owning 10 to 20 acres of cane. Such growers find a great difficulty in crushing their cane in proper time and are therefore required to keep some of their cane as Adsali (18 month's) crop. The statement below gives full details of the trials :—

Name of mill.	Price.	Length and diameter of roller.		Number of men engaged at the mill.		Extraction from 100 lbs. of canes.	Make and finish.	Number of bullocks or B. H. P. required.	Cane crushed in one hour.	Name of the firm from whom obtainable.
		Main.	Side.	Men.	Women.	Per cent.				
	Rs. a. p.								Lbs.	
Power crusher ...	2,235 0 0	20″ × 14″	3 of equal size.	2	7	72	Fine and strong.	14 B. H. engine.	4,500	Messrs. Greaves Cotton & Co., Bombay.
Chatanooga power crusher No. 44	950 0 0	9″ × 9″	6″ × 9″	1	2	70	,, ...	5 ,, ...	1,600	Messrs. Marshall Sons & Co., Bombay.
Chatanooga No. 23	200 0 0	7″ × 14″	7″ × 7″	3	...	68	Fine and strong.	4 bullocks	750	Do.
Poona mill with screw arrangement.	175 0 0	18″ × 11″	3 of equal size.	4	...	68	Rough and not strong.	4 ,, ...	750	Mr. Bari, of Poona.
Poona ordinary mill.	150 0 0	18″ × 11″	,, ...	4	...	64	,, ...	4 ,, ...	750	Do.
Pearl mill	325 0 0	10″ × 8″	8″ × 8″	3	...	70	Fine and strong.	4 ,, ...	850	Messrs. Clubwalla & Co.
Nahan mill	160 0 0	9″ × 9″	Feeding roll 7″ × 7″ Megass roll 9″ × 9″	2	...	66	Strong ...	2 ,, ...	425	Messrs. Raichand D. Allibhoy & Co., Amreli, Káthiáwár.
Hatti mill	90 0 0	9″ × 9″	Feed roll 7″ × 7″ Megass roll 9″ × 8″	2	...	68	,, ...	2 ,, ...	375	Messrs. Burn & Co., Calcutta.

Furnaces.

38. The Poona furnace is becoming popular year after year. Several such furnaces are now in use in most of the districts of the Deccan. The improved furnaces have also been adopted in many places in Sátára, Sholápur and Násik. The multiple furnace has been erected at Sholápur on Mr. Warad's estate, where power crusher is being used.

Demonstration and Education.

39. Along with the demonstrations on the College farm for the cultivators of the Deccan districts a similar demonstration was arranged on the Mánjri Farm for those who were interested in cane growing.

The usual vernacular sugarcane class, which is getting popular year after year, was held in December 1914. The class was well attended, the students being principally from Násik and Nagar districts, where new canals have been opened and where people are really in need of education in this line. The important feature of this year's class was that a few of the Patkáries and Inspectors who are directly in charge of the distribution of canal water amongst the cane growers on the Godávari canal were deputed by the Irrigation Department. This example was followed by the officers of the Mutha canal, who sent all their men, numbering about fifty, for three days, when they were given special instructions. Such men will be of immense use in spreading the improvements amongst the cane growers.

Besides, the students of the Poona Agricultural College, Vernacular School, Training College for Men and Women, Poona, and Civilians Class were given instructions from time to time in cane growing and gul making. The farm is thus serving as a central institution for sugarcane study in the Bombay Presidency.

Trained gulvas.

40. The demand for expert gul makers is increasing from year to year. They were sent out in several districts of the Deccan, Karnatak and Konkan and also in Central Provinces and Bellary. This shows that the Poona method of making gul is gaining popularity not only in this Presidency but also outside.

Implements.

41. (*1*) *Iron ploughs and other implements.*—The implements sold from this farm to the cultivators of the Mutha valley were worth Rs. 2,500. Besides, some ploughs have been kept for hiring out to the cultivators and these were out the whole of the season.

During the year Chatanooga one way ploughs Nos. 25 and 45 were tried. The plough No. 45 was found to be suitable to the tract and to be superior in work to Ransomes or Arlington ploughs. Its price is Rs. 56.

42. (*2*) *Turmeric rubbing or polishing barrel.*—The simple machine made on the farm was found to be more effective and cheaper than rubbing by feet, which is in vogue in places where turmeric is exstensively grown as in the Sátára district. The cost of polishing by this machine comes to Rs. 0-1-3 per maund of 80 lbs. as against Rs. 0-5-0 by the ordinary method. Full information is given in leaflet No. 4 of 1915.

Saccharometers.

43. The use of the saccharometer for determining the ripeness of cane has become popular in a short time amongst the cane growers of this valley. The cultivators round about the Mánjri Farm take their canes to the farm laboratory to ascertain the ripeness by this instrument. It is also becoming popular in other parts of this Presidency, where as many as 60 were sold during the year. Generally in each district now, there is a saccharometer. Besides, these instruments have been supplied to the Agricultural Departments of other Presidencies, such as Central Provinces, United Provinces and Burma. The saccharometer with the cylinder costs Rs. 3-12-0 and can be had at the Mánjri Farm. Instructions as to its use, etc., are given in leaflet No. 4 of 1914.

Double beans.

44. Its cultivation on the Mánjri farm during the year gave a bumper crop and fetched a very high price in the Bombay market. The yield per acre amounted to 2,732 lbs. of green pods and 723 lbs. of seed and was worth Rs. 370 per acre, while the cost of production was Rs. 162.

Scientific work.

45. (*1*) *Ripeness in Pundia cane.*—The highest purity observed in ripe Pundia cane juice was 92, which is equal to purity of good canes of the world.

46. (*2*) *Adsali* (*18 months*) *cane.*—The experiments proved that the purity of an Adsali cane if the crop is standing is always higher than 92; but when lodged, it is about 80—85. Even though the cane begins to deteriorate in the hot weather the growth starts again as soon as the monsoon commences, utilising the products of inversion for its growth. The purity of juice increases on the whole. The lower and middle portions remain very high in purity with the topmost portion very low at the same time.

47. (*3*) *Arrowing and its influence on the composition of cane.*—The local variety Pundia very rarely flowers, and if it flowers at all it is a practice amongst the cane growers to remove the arrows. To get at the truth of this practice an experiment was taken in hand and the results showed that the removal of the arrows did not seem to have any effect on the composition of the cane.

48. (*4*) *Gul from Toddy* (*Date palm*).—Gul of good colour and grain can be prepared from fresh toddy by the same method as is followed in the case of cane juice. The conversion of toddy gul will be a source of good income where toddy trees are grown in large numbers and where there is no demand for the liquid product.

DAIRY.

49. The necessity of the supply of pure and cheap milk is being felt more and more day by day. So any information which will throw light on the factors involved will be of utmost importance. If the results of the Agricultural College Dairy are reviewed, some useful data can be obtained on the following points :—

1. Breeds of cows and buffaloes suitable for dairy industry in the Deccan.
2. Possibilities of improving the milk yield by selection.
3. Minimum quantity of annual milk yield to make a profitable dairy animal.

50. (1) *Breeds of cows and buffaloes suitable for dairy industry in the Deccan.*—Out of the three breeds of cows Sindi, Gir and Aden and four breeds of buffaloes Surati, Jaffarabadi, Delhi and Deccani,—Sindi amongst the cows and Surati amongst the buffaloes seem to be most

suited for the Deccan. The following statement compares the average annual milk yields of the various breeds together with their dry periods :—

Name of reed.	Average number in the herd.	Period under observation.	Average annual yield per head.	Average dry period per year.	Remarks.
		Years.	Lbs.	Days.	
Sindi	26	12	2,022	124	
Gir	9	10	1,604	150	
Aden	5	12	1,972	113	
Surti buffaloes ...	37	12	2,161	136	
Delhi „ ...	11	10	1,858	155	
Jaffarabadi ...	4	10	2,476	124	Only a few animals under observation.
Deccani	6	8	1,275	163	Do. do.

51. (2) *Possibilities of improving the milk yield by selection.*—By keeping individual animals under observation it is noticed that there is a great variation between the average yields of the whole herd of a breed and the best individuals, as will be seen from the following :—

Name of animal.	Name of breed.	Years under observation.	Average annual milk yield.	Average annual yield of the whole herd of the breed.
Cows.			Lbs.	Lbs.
Zankar	Sindi ...	13	3,413	2,022
Changuni	„ ...	5	3,551	
Mohan	„ ...	9	2,968	
Buffaloes.				
Kaveri	Surti ...	13	3,061	2,161
Sajani	„ ...	9	3,526	
Lavangi	„ ...	7	3,987	

52. (3) *Minimum quantity of annual milk yield to make a profitable dairy animal.*—Supposing that an animal on an average will yield 2,000 lbs. of milk annually, it will cost as follows to produce 100 lbs. of milk :—

	Rs.	a.	p.
Interest on the outlay at 10 per cent.	0	10	0
Food and fodder	7	0	0
Hire of cattle-shed	0	4	9
Attendance	0	9	6
Feed and fodder store hire	0	4	0
Delivery charges	0	8	3
Contingencies	0	13	6
Supervision	0	8	0
Rs. ...	10	10	0

If this 100 lbs. of milk is valued at 11 lbs. per rupee, at which rate it is easily saleable in the Poona market, it will fetch Rs. 9-1-0, resulting in a loss of Rs. 1-9-0 on 100 lbs. or Rs. 31-4-0 on one animal annually.

53. Now if the annual milk yield is increased by 100 lbs. the cost of production will increase only on two items, *viz.*, concentrated food and delivery charges. The additional concentrated food will cost Rs. 2-1-6 and delivery Rs. 0-8-3, making the total of additional expense of Rs. 2-9-9 ; while the additional output will fetch Rs. 9-1-0 or a net gain of Rs. 6-8-3 per 100 lbs. of increase in annual yield. At this rate to make an animal self-supporting the average annual yield must be increased by 500 lbs., *i. e.*, an animal giving an average annual yield of 2,500 lbs. will only be self-supporting.

Another way by which an animal yielding even 2,000 lbs. of milk annually can be made profitable is by reducing the cost of production. This can, however, be effected in the cost of fodder only ; by raising one's own fodder crops instead of buying them or having cheaper grazing facilities.

POULTRY.

54. During the year poultry farming has been added to the Dairy on a small scale. A start has been made with seven birds consisting of Orpingtons and Leghorns.

G. K. KELKAR,
Acting Professor of Agriculture.

APPENDIX H.

REPORT OF THE AGRICULTURAL CHEMIST FOR THE YEAR 1914-15.

1. The office and laboratory of the Agricultural Chemist to the Government of Bombay have been under my charge for all the year except from February 9th to March 5th, 1915, when I was on privilege leave. During this time Dr. W. Burns was in acting charge of the work.

2. The routine analytical work of the laboratory was about normal, and represents about the amount required by Government and the public from the Agricultural Chemist. There is apparently a large drop in the number of samples examined for the previous year, but this is more apparent than real, as in the previous years a large amount of work was done in connection with Mr. Smart's examination of the canal areas of the Deccan, and a special establishment was maintained for this purpose. The following table giving the number of samples examined since the opening of the laboratory shows how the work has gradually increased :—

1906-07	596
1907-08	1,192
1908-09	1,153
1909-10	2,119
1910-11	1,216
1911-12	1,423
1912-13	1,661
1913-14	3,018
1914-15	1,560

3. The character of the analyses done is shown in the following list for the current year :—

Nature of samples.	Number.
Soil	402
Manure	200
Feeding Stuff	162
Water	344
Gul and Sugar	8
Oilseeds and Oil	129
Milk	35
Butter and *Ghee*	37
Milk products	4
Fruit	33
Tea	38
Tobacco	65.
Miscellaneous	103
	1,560

4. I have always maintained that the real test of the success of the laboratory in filling a public need is best shown by the use made of it by the public, both by actual cultivators and by those responsible for industries directly dependent on agriculture. The number of samples received for analyses from the public as distinguished from those from Government farms and departments continues large, and was as follows during the year under record :—

Nature of samples.	Number.
Soils	89
Manures	74
Feeding Stuffs	70
Water	176
Gul and Sugar	3
Oilseeds and Oils	20
Milk	19
Butter and *Ghee*	15
Tea	38
Miscellaneous	73
	577

5. The character of the work done has differed little from that in previous year, but there are a few special matters which have come up during the period under review which merit mention. The number of samples of water examined for agricultural purposes continues to be very large and shows how exceedingly insistent is the question of salt or alkaline waters with all who undertake irrigation. I have examined during this year a large number of samples of water in connection with applications for reduction of assessment in the Alibág táluka of the

Kolába District and the results of my analyses have guided Government in their decision. The difference in the amount of the salts and in their character within a very small distance is extraordinary, and certainly far more than would be expected.

6. The report by Mr. W. W. Smart on the problem of salt in the soils of the irrigation tracts of the Deccan has raised a large number of new problems as to the origin and control of the salt land which tends to develop in these areas. I am co-operating with the irrigation department in making a closer investigation of this question in a limited and badly salt-affected area near Bárámati under the Nira Canal, and we hope to reach further definite conclusions in this matter.

7. The whole question of the underground waters of the trap area in Western India, their nature, the origin of their salts and the distribution of the water streams is one of very great importance, and in various aspects its study has taken much of my time. Work in testing the value of Mansfield's Waterfinder for the location of streams of underground water has continued during the year and a bulletin on this matter is now in the press. Another bulletin embodying a portion of the results of six years' study of the composition of the well waters of the trap area and its variations is also in the press, and will be issued immediately. Another study (with Mr. S. R. Paranjpye) of the water of a series of intermittent springs at Rajápur in the Konkan has been issued, and the results of an examination of the hot springs of the Ratnágiri District has been submitted for publication. This last investigation has led to conclusions with regard to the probability of boring operations in the Konkan being successful, and I visited the area in question, with the Agricultural Engineer to Government in September last in connection with the matter.

8. Western India contains a number of special kinds of soil which represent the seats of particular industries or are unproductive areas in the middle of very fertile areas. As an example of the former we may take the spice garden area in North Kánara; of the latter the *mhanvat* soils of the Kolába District. With regard to these two types we have taken up the study of the soil in my laboratory. Mr. Sahasrabuddhe is devoting his attention primarily to a study of the spice garden soils of Kánara, and a first contribution to the subject is almost ready for the press. Mr. Kanitkar has more recently taken up the study of the soil of *mhanvat* lands, and we hope to make considerable progress in this matter during the coming year. There are other types of land urgently needing enquiry and these will be worked at as soon as time and opportunity occurs.

9. There is little to report new in the matter of work on manures. No new materials for use as manure have appeared on the market during the year, but the use of oil-cakes for manure and of artificial manures shows a tendency to widen. The former have been lowered in price as a result of the European war: the price of the latter has been raised. But a slow development is going on in the use of both these types of material.

10. I have continued and undertaken a considerable number of experiments during the past year in the use of artificial manures for our leading crops, and particularly of potash manures, of sulphate of ammonia, and nitrate of soda. The work has now been in progress for three years, and has been immediately under the control of my assistant, Mr. S. R. Paranjpye. A number of very definite conclusions have been reached with tobacco, with potatoes and with a number of other crops, and these will be issued almost immediately, with the data on which they are based, as a bulletin of the Agricultural Department. The matter is an important one as I think that the use of artificial manures, more particularly for crops under irrigation, is bound to extend in the near future to a considerable extent.

11. The question of improvement of the milk supply has been very much to the fore during the past year, and evidence of the exceeding badness of the present supply is accumulating as a result of work done in my laboratory and elsewhere. The whole matter has now been referred to a special committee and such data as I have will be laid before that committee.

12. Closely allied to the question of milk supply is that of the preparation of milk products such as casein,—and that of the quality of *ghee* now in the market. In regard to casein I was called in during the year by the municipality of Anand (Gujarát) to advise as to the disposal of the residual liquid from casein manufacture, which had become a nuisance to the town. I was able to suggest what I think will be an efficient method of dealing with it. As regards *ghee* it must be recognised that a very large proportion of the so-called *ghee* now in the market is not *ghee* at all, but animal fat, or animal and vegetable fat mixed, or these mixed with a certain amount of mineral oil. A large number of samples of *ghee* exposed for sale in Poona City and sent to me by the City Magistrate, proved to be nearly all composed essentially of goats' fat, mixed in some cases with a little sesamum oil, or some mineral oil. None of them contained any real *ghee* whatever.

13. My laboratory has given a good deal of assistance this year to Mr. P. C. Patil, Extra Deputy Director of Agriculture, Konkan, who has been investigating the possibility of profitably making sugar from the juice of the toddy and *brab* palms particularly in the Thána District. I understand that Mr. Patil will be publishing his results in the near future.

14. These are just a few of the special matters which have come before my laboratory during the year. Many enquiries have further been made as a result of the war, and the utilisation of Indian products instead of imported ones during the present period of stress.

And, beyond these, a considerable part of my staff are engaged in investigations which have occupied their attention for a long period. The chemical study of the betel vine,—the most important garden crop in India—has been continued with the ultimate object of ascertaining whether the quality of the leaf cannot be improved by modifications in the methods of cultivation and preparation for the market. The second memoir on the subject,—of which I wrote in my last report,—has been delayed for the completion of certain data, but is now almost ready, and gives an important and practical improved process for the bleaching of the leaves. During the year my assistant, Mr. D. L. Sahasrabuddhe, has published an account of the acid secretion of the gram plant, and, as already remarked, I have issued and am issuing reports on the well waters of the trap area of Western India on the hot and intermittent springs of the Konkan, on the use of the waterfinder for the detection of underground water in the trap area of Western India. Beyond this papers on safflower oil, on buffalo milk, and on the conditions of the spice garden cultivation in Kánara are in preparation and almost ready for issue. I have moreover in active preparation bulletins on fodder crops in Western India, embodying the results obtained in my laboratory for several years,—and (as already stated) on the present utility of artificial manures with a number of our most important crops.

15. My staff has worked well during the year. Mr. V. A. Tahmane, B.Sc., L.Ag., has remained Senior Laboratory Assistant throughout the year. The services of two members of the laboratory staff—Messrs. D. D. Abhyankar, B.Ag., and V. J. Atgur, B.Ag., have been lent to the Water Analyses enquiry now being conducted by Captain J. Morrison, I.M.S., Mr. N. R. Gurjar, B.Ag., has been employed with the waterfinder, and Mr. S. R. Paranjpye, B.Ag., is in charge of the district work on artificial manures which is under my control.

HAROLD H. MANN,
Agricultural Chemist to the Government of Bombay,
Poona.

APPENDIX I.

SUMMARY OF WORK DONE UNDER THE ECONOMIC BOTANIST FOR THE YEAR 1914-15.

ENQUIRIES.

Each enquiry mentioned below refers to a complete correspondence on the question and not to single letters:—

Subject.	Number 1914-15.	Number 1913-14.
Botanical Advice	37	9
Citrus	24	13
Diseases	73	46
Enquiry	44	78
Grapes	12	30
Horticulture	57	4
Konkan Horticulture	19	2
Identification	28	23
Manures	12	3
Mango	30	30
Plants and Seeds	87	82
Plantains	6	3
Personal	26	6
Rubber	5	7
Sericulture	1	2
Sugarcane	3	7
Supply of Specimens	7	19
Seed Testing	47	28
Teaching	13	6
Weeds and Grasses	14	21
Wheat	6	5
	553	422

EDUCATION.

The following pupils underwent special training in Ganeshkind Botanical Garden:—

Name.	Town or village.	Subject.	Period of Training.
1. Hardikar ...	Násik ...	Horticulture ...	June 1914—February 1915.
2. Mistri ...	Bombay ...	Do. ...	May 1914—April 1915.
3. Shrotriya ...	Poona ...	Fruit culture ...	.....
4. Shirgaonkar ...	Belgaum ...	Oil Engine driving ...	Jan. 7—14, 1915.
5. Chobe ...	Nagpur ...	Budding oranges ...	Jan. 15—16, 1915.
6. Neginhal ...	Gokak ...	Fruit culture ...	Oct. 15—Nov. 15, 1914.
7. Kulkarni H. G. ...	Dhárwár ...	Do. ...	Oct. 24—Nov. 15, 1914.
8. Kulkarni S. N. ...	Poinad ...	Budding and grafting and Oil Engine driving.	Jan. 19, 1915, to Feb. 26, 1915.
9. Vasavda ...	.....	Oil Engine driving ...	.....
10. Limaye ...	Poona ...	Mango canning ...	Occasional visits.

In addition the B.Ag. class was taken every week for practical horticulture; the short course likewise. The students of the F.Ag. class had occasional excursions in the garden. The students of the Training College for men, Poona, paid some visits; also the students of the vernacular Agricultural School, Loni. The I.C.S. class had two mornings in the garden.

A new feature of this year's teaching was the class in arboriculture for the Public Works Department subordinates. This was in charge of Mr. H. P. Paranjpye, B.A., Assistant Economic Botanist, and was held partly in Ganeshkhind Botanical Garden, partly outside, and partly in the College. It was a success and will be repeated this year with the addition of a little training in horticulture.

Mr. Anantanarayana Iyer was deputed by the Travancore State for a year's training in Plant Breeding under the Economic Botanist (with special reference to coconuts and rice) and fruit culture. This training ended in June 1915 and Mr. Iyer has now assumed charge of his new duties in Travancore.

Lectures and Publications.

Magazine Articles.

	Article.	Author.	Magazine.
1.	The Strawberry Cultivation of Mahábleshvar.	W. Burns, Economic Botanist.	Agricultural Journal of India, Vol. IX, No. 3.
2.	*Opuntia elatior*, the Prickly Pear of the Bombay Deccan.	Do. ...	Agricultural Journal of India, Vol. IX, No. 4.
3.	Grafting the Mango Inflorescence.	W. Burns, Economic Botanist, and S. H. Prayag, B.Ag.	Journal of the Asiatic Society of Bengal, Vol. XI, No. 1. (New series.)
4.	Morale and Technique ...	W. Burns ...	Poona Agricultural College Magazine, Vol. VI. Nos. 1 and 3.
5.	Botanical Names ...	H. M. Chibber, M.A., Assistant Professor of Botany.	Do. Vol. VI, 4, and Vol. VII, 1.
6.	Red Rot in Sugarcane ...	G. S. Kulkarni, L.Ag. Assistant Mycologist.	Shetki Shetkari and Vakkaligaru Vakkalitanavu.
7.	Smut of Jowar ...		
8.	Investigations on Papaya ...	L. B. Kulkarni, L.Ag., Graduate Fieldman.	Poona Agricultural College Magazine, Vol. VI, 2, and Agricultural Journal of India, October 1914.

Separate Papers and Publications.

	Article.	Author.	How published.
1.	Annual Report of the Ganeshkhind Botanical Garden, 1914-15.	W. Burns ...	As Annual Report.
2.	Annual Report of Experimental Work of Staff of the Economic Botanist done outside Ganeshkhind Botanical Garden.	Do. ...	Do.
3.	An Examination of the Seed Supply of the Sholápur District.	Seed Testing Department.	Bulletin No. 67 of 1914.
4.	A List of Diseases of Economic Plants occurring in the Bombay Presidency.	H. M. Chibber ...	Bulletin No. 65 of 1914.
5.	The Genus *Rhizoctonia* in India.	S. L. Ajrekar, B.A., Assistant Professor of Mycology, in collaboration with F. G. F. Shaw.	Memoirs—Department of Agriculture in India, Vol. VII, No. 4.

Various leaflets, mainly on fruit culture, have been written for the Agricultural Department leaflet series.

Lectures have been delivered at various centres on plant diseases, fruit growing, and popular science.

Research and Demonstration.

The propagation of the mango tree has continued to receive attention. The following are new methods which will prove useful:—

(*a*) *Topworking.*—This means the heavy pruning of an old tree and the grafting of several scions on to the new shoots that arise. It is an excellent method of renewing old or useless trees.

(*b*) *Layering.*—The making of an incision in a stem and burying the cut part in a pot. Roots form on the cut. This is simpler than grafting and will be useful where no skilled grafting operator is available.

(*c*) *Gooty* (sometimes called "Marcotte").—The removal of a ring of bark and the tying of mud on to the spot with gunny bag material. The whole is moistened by drip from an overhanging pot. Roots form at the cut. This is useful in conditions similar to those referred to in the last mentioned method.

The mango has at last been hybridised artificially both at Ganeshkhind and Bassein. Different varieties were crossed and the resulting fruits showed some characters of each parent. Their offspring will be carefully watched.

The ripening of the Alphonse and the Pairi mango fruit has been carefully studied. The Alphonse keeps about 24 days and the Pairi 16 days in ordinary room temperatures. The Alphonse colours beautifully even when plucked green, the Pairi does not. Bacterial infection causing rot appears to take place through the scar of the fruit stalk. If this is sealed by wax it is probable that the fruits will keep longer. This will be tried next season.

A clever device to catch the mango fruit fly has been invented by Mr. Ramrao Kasargode, L.Ag., Lecturer in Entomology. He discovered that a distillate of the *tulsi* plant (*Ocimum sanctum*) is peculiarly attractive to the males of this species and can be used as a bait to lure them to fly papers and traps.

Mango canning under steam pressure has resulted in fair success, but it appears we have on the whole been using too high pressure for too long periods. Experiments are being continued.

The manuring of citrus trees has received some attention and it has been shown that safflower cake with sulphate of potash and bone meal gives excellent results. Stock testing continues. Pomeloes on Mahalung (*Citrus medica* proper) stock have given a fair harvest. Greatest vegetative vigour is still shown by trees grafted on the Jamburi (*Citrus medica* species) stock. It was found that budwood kept best when packed in fine saw dust that had been thoroughly wetted by rain.

The search for a seedless guava continues, by selection, by repeated layering, and by keeping a look-out for favourable sports. No distinct progress has yet been made. Guava pruning is being taken in hand.

Some remarkable facts regarding the papaya have been ascertained. Some trees gradually change the sex of their flowers as they grow. Crosses between various types of papaya trees have given seedlings which are now being studied.

The experimental manuring of grape vines shows results in favour of fish manure and sulphate of potash in combination. The difference between gardens sprayed for mildew and those not sprayed has again been thoroughly studied at Násik, with results conclusively in favour of spraying. The number of sprayings has now been reduced to three. Many new varieties of grapes from France and America have been introduced.

Figs seem to do best in poor calcareous soil with good drainage. Fig rust was bad this year in the garden and seriously affected the outturn. The pruning of the fig is now being studied with satisfactory results.

It appears that custard apples cannot produce fruits from flowers appearing in April. Those appearing in the following month do set fruits.

The outturn of various wild fodder grasses has been calculated on the basis of experiments carried on in the garden. The peculiar requirements of several such grasses are now definitely known, and also their fodder value as shown by analysis and experimental feeding. All these facts will appear in a bulletin to be issued shortly.

The work on rice shows that plants of the same pedigree vary considerably in the length of their growing period according to the climatic conditions of their environment. Natural and artificial hybrids of rice have been studied, and the inheritance of certain important characters examined. A tentative classification of the Bombay rice varieties has now been made and will be tested before publication. The collection of rice varieties at Alibág is being continued for purposes of study.

The spraying of betelnut palms in Kánara against the Koleroga disease has been carried on with increasing success by Mr. G. S. Kulkarni, Assistant Mycologist. The people are now purchasing sprayers for themselves and the practice is taking hold of the district. The infection of sugarcane by red rot is being studied. Interesting observations have been made on the smuts of cereals, especially jowár, and also on the smut of sugarcane. Four forms of jowár smut are now established, of which only one is amenable to treatment by copper sulphate. The destructive soil fungus Rhizoctonia, a pest of potato, Elephant's foot, cotton, and many other plants, forms the subject of a recently published memoir by Shaw and Ajrekar, the latter being the Assistant Professor of Mycology of this Department.

The staff of the Economic Botanist have toured extensively for the purposes of fruit survey, and to investigate fruit plantations which the owner's desired to improve. In most cases the defects found have been close planting, over-watering, and lack of inter-cultivation. Experiments carried out in fruit growers own gardens clearly show the advantage of scientific treatment of such plantations.

W. BURNS,
Economic Botanist.

APPENDIX J.

ANNUAL REPORT OF THE AGRICULTURAL ENGINEER DURING 1914-15.

Introductory.

There has been no change in the staff of this department during the year under review, and I held charge of the office of the Agricultural Engineer throughout the year.

An impetus has been given to steam ploughing since the publication of the last report on the subject and as a result of the successful working the first year a second set of tackle was purchased and placed in my charge.

Boring likewise has received considerable attention owing to the Committee's report on water supply in the Presidency and is being carried out on a much larger scale than hitherto.

Pumping has also received extra attention although erection work in this branch has not increased in the way anticipated.

Endeavours have also been made to effect improvements in branches of the work such as cane crushing, oil extracting, ginning, shredding and baling.

Power Pumping.

Engine driving.

Last year I dealt with the various causes of failure attributed to pumping plants and their remedies. As a result of this it seems that every pumping plant, owner or those about to purchase one realize the difficulty of drivers and at once consider the question of driving their own plant or depute a relative or friend to do so. This is a move in the right direction.

Obstacles to the installation of 2½" Pumping plants.

Satisfying myself that the 2½" centrifugal pump was helpful to well irrigation, I endeavoured to find out the difficulties in the way of such a plant becoming popular. The first is undoubtedly the foundation trouble, especially in black cotton soil, the second is belt slip, and the third is shortage of capital. To obviate such difficulties I designed a combined pumping plant and tested it on the experimental well adjoining my workshop. The results are tabulated below :—

B. H. P. of Engine.	Size of pump.	Fuel consumption per day of 8 hours.	Cost of fuel consumption.	Cost of Lubricating oil, waste, etc.	Driver's wages.	Acres irrigated per day.	Total cost with usual interest and depreciation.	Maximum total head against which the plant can work.
			Rs. a. p.	Rs. a. p.	Rs. a. p.	A. G.	Rs. a. p.	
4 B. H. P. High Speed.	2½" Belt driven.	3½ gallis. ...	2 0 0	0 4 0	0 6 0	1 11	3 0 0	60'
Do. ...	3' Chain driven.	Do. ...	2 0 0	0 4 0	0 6 0	2 0	3 0 0	40'
Do. ...	2½" Link belt driven.	Do. ...	2 0 0	0 4 0	0 6 0	1 11	3 0 0	60'

The result of my experiments is that for small pumping plants, and especially on wells, expensive concrete foundation, thermos syphon system of circulation and belt alignment troubles are entirely dispensed with, moreover the time required for fixing is not more than 2 days and the total cost of the plant for ten to twelve acres of sugarcane does not exceed Rs. 1,300.

Crude oil Engines.

Many persons have been misled with the figures published by firms with regard to expenses of the semi-diesel crude oil engines. To test these figures I have fixed a 10 B. H. P. Petter Vertical Enclosed Type crude oil engine in my workshop and find that it actually costs Rs. 3-13-0 for an 8 hours working day including fuel, lubricating oil, interest, depreciation, driver's wages, etc. This design of engine does not, however, lend itself to the cultivator's use.

The owner of the pumping plant at Dahivadi, Sátára District, writes that his crude oil engine and pump fixed by this department are working satisfactorily, and he thinks that if he were to irrigate the same area by means of mhotes he would have to pay at least four times the amount that is required with the pump. I believe this statement to be true as I have heard

from other sources that the consumption of this engine is wonderfully low. Therefore crude oil engines of more than 15 B. H. P. on the 4 cycle open type system may be considered reliable and economical from the point of running expenses.

Nangaon, Ranjangaon and Bhambora.

It will be interesting no doubt to carefully peruse the figures given below, *i.e.*, estimated running expenses for three large pumping plants on the Bhima River each having different designed engines and pumps. The physical conditions are identical, the only difference being in the total lifts, *viz.*, Ranjangaon 43′, Nangaon 47′ and Bhambora 50′.

Name.	Type and power of Engine.	Type and capacity of Pump.	Total cost of project.	Capacity of plant in gallons per minute.	Estimated cost per annum.	Remarks.
			Rs.		Rs.	
Ranjangaon ...	25 B. H. P. oil engine.	5″ centrifugal ...	14,000	560	5, 0	Annual cost of working is for 350 days of 10 hours. The initial costs vary in all the cases owing to the fact that designs differ immensely in each case. At Nangaon there are several pumps, pipes, and other machinery.
Nangaon ...	37 B. H. P. suction producer gas engine.	10″ and 12″ low pressure Turbine pumps and reciprocating pumps.	22,200	1,320	6,000	
Bhambora ...	60 B. H. P. crude oil engine.	10″ centrifugal pump.	15,000	2,000	3,378	

All the above plants are near Dhond and easily accessible from the G. I. P. Railway. The most important points to be noticed in making this comparison are that (1) crude oil engines of 15 B. H. P. and over may be considered reliable and economical to use; (2) river sites of large heads should be contemplated only if the scheme is to be started on a grand scale. The larger the area the less will be the running expenses per acre; (3) and that expert advice is necessary in all such projects.

Detailed information and actual figures of expenditure for Bhambora pumping plant will be given when it has been in use for one year continuously.

It would be advisable if prospective power plant owners and others interested in power pumping paid a visit to these plants to study their designs and the local conditions, etc.

IRRIGATION ON WELLS.

A large experimental well has been built by Government near the college workshops in the Agricultural College grounds for experimenting with various water lifts.

Interested cultivators are invited to visit this well and to ascertain what particualr plant will suit their individual case best. Previous intimation of their visit is necessary so that some one can be deputed to explain to them particulars of each plant in detail. They can also be taught how to handle such machinery at the workshops.

Actual figures.

When all the water lifts on this well are erected many problems respecting power pumping can be solved. Guess work and estimated figures too often fail to be realized. In short absolute practical data will be collected.

WATER METER.

This year a Worthington water meter has been fixed on the delivery pipe of the pump at Ganeshkhind Botanical Gardens. The idea is to ascertain the correct number of gallons required for different crops per acre. This information will be extremely useful both to the department and to the cultivators.

One of the combined pumping plants already referred to was hired out to a cultivator at Kalas near Yerávda where he wished to dig a well but was unable to do so on account of the increase of water, which was more than mhotes could cope with. This plant was in use for about a month during which time the owner was able to finish his well work. At the time of returning the plant he expressed his heartfelt thanks for the help rendered without which he could not have built his well.

This plant was afterwards hired to a cultivator at Hiraj near Sholápur. Here this gentleman was growing about eight acres of sugarcane, but when the crop was nearly ready for harvesting the whole of his well *tharola* fell into the water, so he straight away appealed to me

for help, and I immediately dispatched the small pumping plant to assist him in his irrigation work. In spite of many difficulties the plant prevented his crop from withering, and he has now decided to purchase a pumping plant for his use and dispense with the mhotes.

From the two instances related it will be seen that the plant has been of immense value and will I am sure meet a long-felt want.

I have tested both belt and chain driven methods on this plant with the object of reducing belt slip and undue friction, and consequently minimising the power absorbed in transmission, and this has been accomplished to a great extent.

The three outstanding features of the plant therefore are: no foundations required; no belt troubles; and no water vessels; moreover as the plant is self-contained no lining up is necessary.

I have induced Messrs. Marshall and Sons of Bombay to take up the manufacture of these plants which mark a great advance in well irrigation, and the plants have since been put on the market.

Demonstrations.

The following machinery was demonstrated at the workshops during the Marátha Conference last December:—

(1) 4 B. H. P. Marshall's oil engine driving a 2½" centrifugal pump mounted on a girder frame and driven by means of a belt.

(2) 4 B. H. P. oil engine driving a 3" centrifugal pump by means of a chain.

(3) Deep well hand pump locally made in my workshops delivering 250 to 300 gallons per hour capable of working against a total head of 100'.

(4) Pathak Shah and Co.'s hand deep well pump delivering about 250 gallons per hour from a depth of 50'.

(5) Myres power deep well pump driven by a 4 B. H. P. Marshall's oil engine delivering about 1,500 to 2,000 gallons per hour capable of working against a total head of 150'.

(6) Combined petrol outfit for deep wells delivering about 1,500 gallons per hour capable of working against a total head of 150'.

(7) Hay baler worked by bullocks.

(8) Hand saw gin.

(9) Musto Patent boring machine worked by engine and manual power.

(10) A 10 B. H. P. Petters crude oil engine driving a grinding mill, an oil mill, cane crusher and a shredder alternately.

Many cultivators were present and were interested in the demonstration, especially with the pumping from a bore hole by means of a hand pump, and the new design of power pump. The whole of this machinery was fixed by my staff.

I was requested by the Agricultural Association to demonstrate the use of agricultural machinery at Sholápur but owing to the outbreak of plague the arrangements were cancelled. I am however thinking of keeping certain machinery suitable for demonstration purposes in Poona ready for dispatch to the various shows held in the Presidency. Demonstrations at the experimental well will be held periodically on completion of the workshops.

Cane Crushing.

The cane crusher at Gokak did excellent work during the year under report. The Farm Superintendent informed me that private cane was crushed on the farm and the charges framed so as to cover working expenses, depreciation, etc.

A small Chatanooga cane crusher suitable to be worked with a 5 B. H P. engine was fixed at Government Farm, Manjri, and tested by the Superintendent and an extract from his report is appended.

Extract from report on the working of the Chatanooga Crusher by the Farm Superintendent, Manjri.

This small power crusher was sent by the Agricultural Engineer, Poona, for full trial in this season.

About half an acre was crushed with it, and the following is a statement of the actual tests taken:—

Date.	Pounds of cane taken for test.	Time.			Pounds of juice.	Extraction percentage.	Time to crush 1,425 lbs. of cane sufficient for one pan = 1,000 lbs. of juice.
		Started.	Stopped.	Time worked.			
		H. M.	H. M.	M. S.			H. M.
6th May 1915 ...	200	10 45	10 53½	8 30	141	70·5	1 0
8th May 1915 ...	500	9 15	9 37	22 0	351	70	1 2

It will be seen from the above statement that the crusher gives an extraction of 70 per cent. The time required to crush a panful of juice (1,000 lbs.) is nearly one hour. It will thus in a day of 10 hours crush nearly 6½ tons of cane, *i.e.*, sufficient for 10 panfuls of juice. Taking on an average 75,000 lbs. for 33½ tons of cane to be the outturn figure per acre, this crusher will finish one acre in five days, or in a season of two months, the usual period, it will handle 10 to 12 acres easily. Owing to the difficulty of getting sufficient labour and bullocks in the season many cultivators are required to leave some of their cane over for the next season, or to crush it when over-ripe, thus losing in many ways. In Manjri and the Nira valleys there are many cultivators who plant more than 10 acres of cane every year, and who require about 2½ months to harvest and crush 10 acres even though two gangs are employed. Such people were really in want of some such small machine to handle their cane in time and this crusher will certainly meet the case. As regards the cost they will have to spend about Rs. 2,500 at the outset, and this will be recovered within a period of five years, which will be seen from the following. By the use of country bullock driven mills, it is impossible to get more than 66 per cent. extraction, while with the power mill at least 70 per cent. is possible or a gain of 6 per cent. Supposing 33 pallas of gul as the average outline figure per acre which they can get on their bullock driven mills, they would get by the use of the power mill 6 per cent. more, *i.e.*, nearly 2 pallas worth about Rs. 40. The cultivator will thus realize as an extra profit for 10 acres, about Rs. 400 in one year due to higher extraction. There are other advantages apart from this such as the saving of all the green tops for his bullocks, less supervision as the cane will be crushed at one place and a gain in rate as he can market the produce in large quantities when the rate is high. Taking only the profit gained by higher extraction a cultivator can very easily recoup his Rs. 2,500 in 5—6 years if he purchases this mill.

In short the above crusher with pump and engine will deal with 25 acres of cane in four months and if a cultivator purchases and works such a plant carefully, a great saving will be effected as compared with the bullock mill.

Chaff Cutters.

This year chaff cutters have been fixed at Dhárwár, Jalgaon, Gokak and Loni and are doing good work.

Training School.

The training school is still held in abeyance owing to the workshop being incomplete. The buildings, it is hoped, will be completed in a short time.

Training of cultivators however in the working of an oil engine, pumps, and other agricultural machinery has been continued as before; six cultivators were trained in oil engine driving and pump managem nt during the year.

To prove how easy the management of these pumping plants is, I have only to relate that a boy of 15 years of age having had six months training at my workshop not only drives pumping plants, but also dismantles and erects them and was in one case entrusted with a complete plant entirely and is much more satisfactory than many professional drivers. At the demonstration held for the Marátha Conference the machinery was in charge of such boys so far as driving was concerned. The prospective owners of power machinery would do well to have a boy trained who will be much more satisfactory in many cases than the coolies.

Motor Plough.

Much has been said and written about motor ploughs and many enquiries have been received in this office on the subject. So it was decided to purchase one and make a few tests on the college grounds. Unfortunately it arrived too late to make any but preliminary tests, consequently actual data are not available. Evidence from such preliminary tests is however

sufficient to prove that many modifications are required before the plough can be considered fit for the cultivator. I propose to continue the tests after the rains and if possible make the necessary alterations in its construction to suit Indian conditions.

Blasting.

In addition to the experiments made at Ankli for deepening wells high explosives were tested at the Ganeshkhind Gardens to clear rocky portions at the surface and make the same suitable for fruit tree cultivation. During the tests 944·23 cubic feet were removed consisting of hard trap and murrum. The total cost of the explosives being Rs. 29-3-0 or 6 pies per cubic foot. This can be reduced considerably when local men are trained to handle the explosive.

Departmental erections.

I give below a list of erections made for Government and private cultivators together with the repairs carried out.

Erections.

Private plants.

(1) Bhambora ...	... 60 B. H. P. crude oil engine and 10″ centrifugal pump.
(2) Sangvi ...	... 15½ B. H. P. oil engine and 5″ semi-turbine pump together with a steel tower 20′ high and 1,800′ of 9″ stoneware piping.
(3) Kendal ...	... 6½ B. H. P. oil engine and a 2½″ centrifugal pump.
(4) Bildi ...	... 3 Platt's gins.
(5) Turmuri I ...	... 1,200 feet of 8″ stoneware piping.
(6) Ankli ...	... 22 B. H. P. oil engine and a 4″ vertical spindle centrifugal pump. This vertical spindle pump is probably the first pump of its kind fixed in the whole of the Presidency. The pump can work against the various heads without any change upto 95′ and will also pump when under water These vertical spindle pumps are most useful when water levels vary considerably and are beyond suction limit.

Government plants.

(1) Gokak ...	... A chaff cutter and 2,000′ of 6″ stoneware piping.
(2) Loni ...	... A chaff cutter and a grinding mill.
(3) Surat ...	... A 2½″ centrifugal pump and one flour mill with dresser.
(4) Experimental well	... 1 14″ Standard flour mill. 1 Chatnooga power cane mill. 1 oil mill. 1 bullock power baler. 1 4 B. H. P. high speed engine driving a 3″ Ruston's helical pump by chain. 1 4 B. H. P. engine driving a Myres force and lift pump. 1 4 B. H. P. high speed engine driving a 2½″ Gwynes pump. 1 petrol deep well pumping plant. 1 hand pump and bore hole pumps.
(5) Jalgaon ...	... Ruston's 9½ B. H. P. oil engine, 40″ Eagle saw gin and one chaff cutter.

Private repairs.

(1) Umbergaon ...	... Refixing the pump together with pipes and overhauling the existing engine, etc.
(2) Bildi ...	... Sundry repairs to Mr. Bildikar's pumping plant.

(3) Turmuri II	...	Repairing the engine and replacing exhaust and water piping.
(4) Pimpalgaon	...	Overhauling and repairing the pumping plant.
(5) Poona	...	Vishnu Sadashiv and Co., repairing the engine and refixing the pump together with piping, etc.
(6) Kothrud	...	Repairing the broken connecting rod.
(7) Kendal	...	Engine troubles removed and the plant put in thorough working order.
(8) Fursangi	...	Mr. Vartak's cane crusher properly set to working order.
(9) Chawdanpur	...	Broken parts renewed.

Government repairs.

A few repairs to Government machinery at farms and other places were carefully carried out. Government plants did not give any appreciable trouble and heavy repairs were not necessary.

GOVERNMENT PLANTS UNDER CONSTRUCTION.

Surat	...	Addition and changes in the machinery on the farm.
Jalgaon	...	Fixing a Platt's double roller gin, a Kibbler and a Bamford's flour mill.
Nadiad	...	A 23 B. H. P. Ruston engine, 3" Ruston's centrifugal pump and one shredder.
Dhulia	...	A 6½ portable Ruston's engine and a 2½" centrifugal pump and a chaff cutter.
Kopargaon	...	A 30 B. H. P. crude oil engine, one bruiser and a press.
Experimental well and workshops.		Various water lifts and the workshops machines.
Dharwar	...	Changes in existing pumping plant.

ADVICE TO ENQUIRERS OUT OF BOMBAY PRESIDENCY.

During the year under report drawings were made and machinery supplied to Indore State and I understand the plant is working satisfactorily.

Several enquiries were received from outside the Presidency and were replied to.

ENQUIRIES.

During the year under report 442 enquiries, received from all sources, may be classified as under:—

Central Division	...	165
Northern Division	...	111
Southern Division	...	96
Sindh	...	31
Outside Bombay Presidency	...	39
Total	...	442

Pumping	...	136
Boring	...	270
Blasting	...	5
Cane crushing	...	5
Steam plough	...	11
Motor plough	...	7
Engine driving	...	8
Total	...	442

Replies were promptly given and suitable cases were recommended for tagai, and every possible help was rendered to cultivators who consulted me. Tours were arranged systematically and visits paid to every site demanding my personal attention. Many trips were made to Dákore and Ranebennur in connection with the steam ploughs as occasional inspection is absolutely essential for a time. The list of plants owned by the department has been omitted as they are now numerous and would take up much space.

Further Improvements on the Combined Plant.

I believe the combined pumping plants can be made to suit wells of two mhotes capacity and can be sold within Rs. 1,000 and I am contemplating the manufacture of a combination set consisting of a 3 B. H. P. engine and a 2″ centrifugal pump to meet the above case. This will be done shortly and results published in next year's report.

Boring.

During the year under report one Assistant Boring Overseer was added to the staff and the addition has proved useful in organising work in the Karnátac and Deccan.

Number of enquiries received.

The total number of enquiries received is 270 which can be divided as below :—

Bombay City	...	...	...	...	40
Gujarát	...	...	...	...	76
Konkan	...	...	...	...	20
Deccan	...	...	...	...	56
Southern Marátha Country		...	...	...	49
Khándesh	...	...	...	...	9
Outside the Presidency		...	...	...	20
				Total ...	270

Interest shown by the public.

From the above number of enquiries it is obvious that agriculturists are taking considerable interest in boring and the results obtained by the department during the year under report will stimulate enquiries in this connection in the future.

Number of sets owned by the department.

The department now possess one 6″ petrol borer, twenty-seven 2½″ and one 4″ Cawnpore sets, fourteen 3″ and 4″ hand power Musto patent boring machines, one 3″ engine power Musto's patent boring machine, and two 3″ Calyx drilling machines. These are distributed as under :—

One 6″ power borer, twenty-eight 2½″ and 4″ Cawnpore sets, three 4″ Musto's patents and one Calyx drilling machine are in Gujarát and the remainder used in the Deccan and Southern Marátha Country.

Experiments with tube wells.

The idea of a tube well has probably its origin in an endeavour to reduce expenditure in digging a well. In the Deccan, especially in the tracts where labour is very expensive, a tube well is more suitable from point of expenditure and sanitation. For domestic purposes it is undoubtedly useful. Any tube giving four gallons per minute may be considered sufficient for domestic purposes for one household. The first experiment in this connection was made in Gujarát in the compound of the Veterinary Dispensary at Anand in Kaira District. The original idea was to dig a well in the compound in the usual way, but on the Director of Agriculture being approached for help he recommended a tube well and a tube well was eventually sunk and a pump fitted. The 6″ power borer was used for the purpose of boring and driving the tube and at 84 feet from the surface water was tapped which rose to within 41 feet from the ground level. The pump delivers water at the rate of 350 gallons per hour, and is more than sufficient for the purpose of the dispensary. In this particular case the initial cost for the tube well is 50 per cent. less than the estimated cost for digging a well in the ordinary way; and the water obtained from the bore hole is far superior to an open well water from point of sanitation as the well is properly sealed and there is absolutely no danger of impure or percolation water running in the tube. I think it necessary to observe here that the 6″ petrol borer when in the hands of the Local Board and until this success was lying idle for want of applicants. The success at Anand has however induced cultivators to send in their applications. In fact I have even now sufficient work booked for this plant to keep it employed continuously for the next twelve months. Since the bore in the dispensary compound two other bores have been successfully made with this machine at Anand.

A similar experiment has been made in my own compound where a petrol engine coupled with a deep well pump having a special barrel prepared in the Departmental Workshop is fixed. The bore is supplying sufficient water for bungalow purposes throughout the whole year except in the months of April and May when the garden supply is shut off. The pump is capable of delivering 480 gallons per hour, *i.e.*, nearly half a kos.

Another plant similar to the above has been fixed in the compound of Mr. Sorabji Dadabhai Dubhash on the Wellesly Road, Poona, near the Goods Depôt of the G. I. P. Railway Company. The bore was commenced from the surface and taken to a depth of 80 feet, water being met at 34 feet from surface. A petrol engine coupled with a deep well pump is fixed and is working very satisfactorily. At the time of writing this plant is delivering 480 gallons of water per hour without any water level depression.

Another tube well is fixed in the compound of the workshops of the Agricultural College, Poona, for demonstration purposes. Here a 70 feet bore was taken and a Myre's hand pump fixed which is delivering 250 gallons of water per hour. In all the cases quoted the hole is properly sealed to avoid impurities and percolation.

A trial of a Brownlie's convoluted tube well is to be made at Kumta in Kárwár District where agriculturists require water to irrigate vegetables. Ordinarily water can be tapped at a depth of 3 feet near the shore. The people sink temporary pits until they reach water and carry the same to the field by means of pitchers. The pit cannot be deepened to increase the supply owing to the sand falling in. A tube well (convoluted) will be useful in such places as it can be lowered without difficulty to a sufficient depth in order to get a copious supply.

Well boring in Gujarát.

During the year under report 55 wells have been bored, of which 43 are successful. Most of the remaining wells are left incomplete at the owner's request. In some cases well masters are found to be obstinate in interfering with the arrangements of the department with the result that the work, in spite of the efforts of my staff, is left incomplete and much valuable time of the department wasted which otherwise could be used for the benefit of more enterprizing cultivators.

In a well belonging to the Parsee Panchayat at Surat where they had a 20 B. H. P. oil engine and a 4″ Ruston's centrifugal pump delivering about 320 gallons per minute but which only worked for an hour each day owing to the supply having diminished, I was requested by the Secretary of the Parsee Panchayat to make a bore. My overseer inspected the well and advised the Panchayat to have a 4″ bore made, and after this was done at a depth of 20 feet below the bottom of the well, water was tapped and flowed like a fountain in the well. The centrifugal pump is now unable to lower the water level more than 4 feet during the winter months and 2 feet during the hot weather months even when the pump is worked 10 hours continuously. This is the first successful boring having an increase of 14 koses. Eleven bores in this vicinity have since been made, seven of which are successful.

Supply at Chharodi Cattle Farm.

A bore was made in the existing well at Chharodi Cattle Farm, and at a depth of 170 feet from the bottom of the well or 200 feet from the surface, water was struck which flowed into a tank at the well side at the rate of 16 gallons per minute. The water was struck in February and continued to flow until the present month August when it ceased. This is a case which I intend to investigate and arrangements are being made to take another bore from the surface.

Another successful bore was made in an existing well at Mahuda in Nádiad táluka and carried to a depth of 235 feet, very fine sand was encountered in this bore, but was eventually shut out by means of the casing and water was tapped in coarse sand.

Well boring in the Deccan and the Southern Marátha Country.

In the Deccan boring is comparatively easy but a great deal depends on how the mukadam treats his cutting tool. In the Karnátak country where we have recently commenced boring such strata as limestone, laterite, granite and quartzite are met with and boring is an extremely difficult matter. Particulars of a few typical bores will it is hoped be interesting and are given below.

1. Karmála boring.

A 3″ bore was taken last year at Karmála in the Sholápur District well known for scarcity of water, and a sub-artesian supply was tapped. The owner has since deepened the well at my suggestion and the water is raised 3 feet from the bottom of the well and cannot be lowered by one mhote after working for 12 hours.

2. Temburni well.

At Temburni in Sholápur District a 200 feet bore was taken and although a sub-artesian supply was struck an ordinary deep well hand pump emptied the bore in three days. I am going to apply a torpedoe charge, and will describe the result in next year's report.

Borings at Agerkhed.

This year we have tapped a fairly good supply at the village of Agerkhed in Indi táluka, Bijápur District. Seven bores have been made, out of which 6 are successful and the water is flowing into the wells. In one instance the water level rose 6 feet over the bottom of the well where there was not a drop of water before boring. In two other instances the water level is within suction limit and cannot be lowered by a 2″ semi-rotary pump worked for ·8 hours continuously, with an average discharge of 1,500 gallons per hour. The depth of boring here is from 30 to 50 feet from the bottom of the existing wells.

Operations are also taking place at Shirur, 9 miles east of Bágalkot in Bijápur District, and at Gokak Canal Farm in Belgaum District. Great difficulty has been experienced owing to the varying strata encountered with which the mukadams have had no previous experience. One bore is, however, nearly complete at Gokak Farm at a depth of 154 feet with a water level within 9 feet of the surface. The strata encountered are sand mixed with lime quartzite, trap, sandstone, and river sand, etc. At Shirur the strata are changing and thus boring becomes more and more difficult. A test of the bore at Gokak is to be made with a 2½″ centrifugal pump and the result will be published.

Devihosur borings.

In the compound of the Vernacular Agricultural School, Devihosur, Dhárwár District, two bores were taken during the year under report to a depth of 40 and 51 feet within 6 and 10 days respectively. The third or the present bore is 63 feet after working for 50 days. The reason of this remarkably slow progress is that we have to pierce through a peculiar mixture of chlorite schist and hæmatatic quartzite. One very soft and the other extremely hard. The object of boring at this place is to find good water for drinking purposes.

Very few bores have been taken in Sátára, Thána, Ratnágiri, and East and West Khándesh Districts and nothing can be stated definitely about the underground conditions prevailing. In the year under report 6 bores have been completed in Poona to an average depth of 80 feet, out of which 5 are successful. The detailed information is given in the statement attached at the end of this report dealing with particulars of bores in general.

Improvements for Efficiency of Work.

During the year I have fitted one of the Musto's hand boring machines with a small engine. The experiment has been successful, for it is seen that a Musto's plant driven by power gives more work at much less cost.

It is now under consideration to convert all the Musto's plants in this department into power plants.

The most important points in rock boring are paying out the rope, and making the tool correct to gauge. Careful attention to the above two points will prevent many accidents common to boring. Circulars are sent to owners of boring machines emphasizing the above points.

A special chemical solution is also being introduced to remove the difficulty of tempering the tool.

Training of Mukadams.

Some of the mukadams have proved themselves to be capable and the rest are expected to do better work with a little more practice.

Mukadams from the following places were trained to handle the Musto patent at the workshops :—

Baroda State	2
Local Board, Chorási táluka	1
Local Board, Nagar District	1
Táluka Local Board, Ranebennur	2
Kadi Prant Panchayat	1
Jodhpur State	1

Experiments for next year.

Next year a few bores will be made in Panch Mahâls, Sind and the Konkan. In the Deccan and Southern Marátha Country bores are in progress.

Help was rendered to the Local Boards and Native States the names of which are given below :—

Nagar District Local Board.

Ranebennur Táluka Local Board.

Baroda State.

Akalkot State.

The process for applying for a boring machine is simple. On receipt of an application an agreement form is sent for the applicant's signature and return. The agreement form is then registered and a machine sent when one is available. When the bore is completed a test of the supply is made, water analyzed and results communicated to the owner.

Mechanical Cultivation.

Introductory.

Steam ploughing or, to be more correct, mechanical cultivation has now extended to Gujarát, and judging from the spirit in which it has been taken up by the cultivators it is obvious that great things may be expected in the future. It is still however purely pioneer work and many obstacles must be surmounted before the system can be adopted generally. When steam ploughing was first advocated no actual practical experience was obtainable so far as India was concerned. Naturally very much in the way of estimating was mere assumption; but we are passing that stage now, and are in the possession of some actual facts and figures in connection with the double engine system. The project however in Gujarát is an entirely different proposition to that in Ranebennur, altough the same system is employed in both districts. The tackle in Ranebennur has to deal with black cotton soil and plough from 16 to 18 inches deep, whereas in Gujarát it is only necessary to plough 8 inches and deal with a transition soil which only requires breaking up. At Ranebennur the sole object of the steam plough is to eradicate hariali grass on cultivated areas, in Gujarát virgin soil is being brought under cultivation.

Ranebennur.

The main object which steam ploughing set out to achieve at Ranebennur is more or less an accomplished fact, viz., eradication of hariali and kunda grasses. To accomplish this in the whole of the infected areas however will take years even with a dozen sets of tackle. Nevertheless there are now as the result of two seasons' work with one set 1,300 acres in the Ranebennur táluka mostly rid of the pest and the rental value of the ploughed land has risen 30 to 40 per cent. Moreover, the cultivators are convinced that steam ploughing is beneficial to their interests; but to conduct ploughing operations under Indian conditions and on a business basis is an extremely difficult matter. Take for instance the year under review. We have had crammed into four months all the difficulties and obstacles to progress conceivable, with the result of course that the season's working is not a financial success, and the main causes of this are: late starting owing to rains; non-delivery of material delayed on account of the war; cultivators' objection to the use of the tractor; some person or persons emptying storage tanks during the night when the staff were away; a troublesome breakage; and intermittent rains after ploughing commenced. A moment's thought will be sufficient to show that none of the troubles enumerated above could possibly be avoided; moreover to make matters worse this season the man who had had special training to take charge of the work fell sick and was away nearly three months, by far the greater part of the ploughing season. Last season was entirely free from all these difficulties. Every precaution of course has and will be taken to ensure success; and with this point in view I have proposed that the ploughing rate be increased from Rs. 21 to Rs. 25 per acre. The peculiar conditions at Ranebennur make it impossible to work more than five months of the year which means of course seven months idle, and if the project is to be run on a business basis a suitable charge must be made to allow for emergencies.

A glance at the balance sheet will show a deficit on the season's working which is entirely due to the unexpected difficulties enumerated in this report. Next year I hope to get extra work done and provided no serious breakdown occurs this year's debt should, I think, be wiped off.

Balance Sheet.

Dr.					*Cr.*		
Particulars.	Amount.			Particulars.	Amount.		
	Rs.	a.	p.		Rs.	a.	p.
Incidental ...	505	3	4	Ploughing charges ...	10,128	13	11
Establishment ...	3,702	2	9	Miscellaneous receipts ...	88	12	11
Fuel wood ...	98	1	6	Stores on hand ...	1,185	3	0
Fuel coal ...	4,356	15	10	Dead stock ...	45	14	0
Repairs ...	1,471	13	6	Minus Balance ...	4 277	3	9
Dead stock ..	100	4	6				
Haulage of coal and water ...	2,410	3	11				
Stores ...	2,485	1	3				
Last year's stores on hand used ...	596	1	0				
	15,725	15	7		15,725	15	7

At this juncture it will not be out of place to make a comparison between Indian and English conditions when deep ploughing is undertaken. In England the coal is about a third of the price which has to be paid in the Ranebennur táluka; and the English farmer hauls the coal and deposits it in the engine bunker; in this country however Government not only have to pay a very high price for coal, they also have to haul it and put it in the bunker, this in itself requires careful organization to ensure the tackle is well supplied. Then again in England the water is hauled by the farmer and actually put in the engine tanks, whereas in this country contractors have to be engaged and, altough they are well paid, generally give trouble. The haulage of coal and water alone this season amounts to Rs. 2,410-3-11. The ploughing charges in England for work of this nature are something like £3 per acre, roughly Rs. 45, and out of this no provision is made for haulage of any description. In India (Ranebennur táluka) the charge has been fixed at Rs. 21 per acre, out of which the cost of coal and haulage of coal and water have to be met. Last but not least is the question of labour. In England a couple of drivers, two ploughmen and two or three handy labourers will run the double engine system for the season and work from 5 o'clock in the morning until 8 o'clock in the evening, only having a total recess of one hour; in this country, however, apart from the expense of hauling, a double shift of men is required and the maximum working day does not exceed 12½ hours. From this it will be seen that many difficulties present themselves. I am very hopeful however and feel confident that now the foundation for steam ploughing has been laid in subsequent years we shall not only see good work done, but work done profitably.

At the close of last season it was decided that a shed was necessary in which to accommodate machinery for over haul purposes and the Ranebennur Municipality allowed us to erect a shed in their compound, the funds for which were provided departmentally.

Tractor.

As proposed in the last year's report a tractor to haul coal and water was purchased and tested during the season under report. In the first instance the tractor was not received at site in time as agreed upon owing to the outbreak of war, and the work commenced in the first week of December last. This delay however meant a loss of about 40 acres work or Rs. 840 in the receipts. This was the first loss of the season. The tackle commenced to work at Yenehosali near Chalgeri station, the source of water being the River Tungabhadra at a distance of three miles from the area. Several cultivators however objected to the tractor passing over their fields; we had therefore to go to the river and return in a circuitous way. Consequently the tractor had to do at least 8 miles for one trip and it was seen that this meant half a day's work, and as two trips were necessary, the whole day was taken up in hauling water alone, consequently there was absolutely no time for coal haulage. It must be distinctly understood that the hauling of water a distance of 3 miles is practically impossible with bullock carts, but by means of mechanical transport is a fairly easy matter. This season, however, the tractor was tested under most adverse circumstances, its failure therefore does not justify its condemnation, but on the contrary it may be considered a safeguard against strikes and a help when we get areas far distant from water-supply, with fairly good roads.

Up to this time we had lost about Rs. 3,000 in receipts on account of the circumstances enumerated above. I do not, however, consider the whole of the amount wasted, although it has considerably contributed to a financial loss this year. At this stage it was decided to move the tackle from Yenehosali to Asundi and engage bullock carts for haulage, keeping the tractor in reserve; this had the desired effect, for no further trouble arose from this source. We had however a serious obstacle in the shape of an important spindle continually breaking, which of course meant another loss in receipts.

Cause of Breakage.

As soon as I could get to Ranebennur I carefully studied the cause of the breakage and found that the engines were working at their maximum power, and that the drum stud on one of the engines was very badly worn, I also discovered that this was brought about by reason of some small studs breaking during the first season, causing the drum and equipment to fall from the engine, and had I allowed this particular engine to continue to run at top speed it would probably have meant the breaking of the drum itself, so I gave orders to slow down, as it was impossible to execute complete repairs necessary without stopping the work entirely. The whole matter will of course be righted during the off season. My chief object in giving these details is to explain the deficit in this year's balance sheet.

During the year under report we worked for 96 days and 4¾ hours or 1,156¾ hours and ploughed 482 acres 13 gunthas averaging over 5 acres a day. The average of course is good, and very similar to the first year. The total charges for ploughing amount to Rs. 10,128-13-11 against Rs. 15,198-13-8 for the first season. Recoveries for ploughing are therefore short by Rs. 5,069-15-9. Total expenses on the plough during the year amount to Rs. 15,725-15-7 as against Rs. 12,196-14-8 for the first year. I venture to think that an increase in rates is now justifiable as we have tried low rates for two seasons, and it is evident that Rs. 25 cannot at all be considered a heavy charge by cultivators because the charges for hand digging are certainly not less than Rs. 40 per acre when digging 10 to 15 inches deep. In support of the above remark the following figures for hand digging and ploughing with Bajack plough are quoted from the annual report of the department for 1910-11, page 35.

Hand digging :—Jower land :—rates for contract work.

(*a*) ½ anna per mar (of 4 square yards) for a depth of 10″

(*b*) ¾ anna per mar for a depth of 15″.

When the wages of a man are Re. 0-3-0 per day the cost per acre works out at Rs. 38 in case of (*a*) and Rs. 57 in case of (*b*). From this it will be seen that there is a distinct gain to the cultivator when the steam plough is engaged. The effect on the soil is splendid and I understand the rental value has increased.

Last season I had trouble owing to the engines priming, so I introduced a reagent which practically disposed of the difficulty.

When considered practicable I would advise the transfer of the Ranebennur tackle to East Deccan and a much larger set purchased for the Karnátac.

GUJARÁT TACKLE.

It was not considered necessary at the time of ordering this tackle to advertize for tenders but simply place the matter in the hands of Messrs. John Fowler and Company, Bombay, after giving them a description of the project and requesting them to get out a set similar to that at Ranebennur. Accordingly this was done, the tackle arriving in Bombay during December last, and subsequently sent to Dakore—the nearest station to the ploughing site,—and after the tackle was erected ploughing operations commenced on the 1st of February. Now the Gujarát project is perhaps the simplest one I have ever had to deal with except in one particular, and that is the peculiar state of the surface of the soil. The texture of the soil is admirably adapted to steam ploughing even during the hottest months of the year, moreover the general lie of the land is level, coal is much cheaper than at Ranebennur, water is plentiful, and the cultivators are prepared to pay the charges without the aid of tagai loans, and the depth of ploughing is not more than 8″, which if the land had been level on the surface would have been an extremely easy job indeed. The peculiar condition of the surface however makes it extremely difficult to traverse.

At first a four furrow plough was tried which did good work, but at the same time made it extremely dangerous for the ploughmen owing to the continual twisting from side to side due to the wheels falling into the holes referred to, so the plough was set aside and the cultivator tried, this implement was much safer, by means of which we were able to cultivate from 12 to 15 acres per day when the engines were kept running fairly regularly.

In Gujarát we have a soil that is extremely easy to break up; only shallow ploughing is required; a ploughing system which is undoubtedly the best to be obtained; and an implement to manipulate which requires the minimum amount of power; a combination which had it not been for the surface irregularities would make it possible to cultivate 40 acres per day when working with a double shift of men.

I certainly anticipated trouble with the holes on my first visit to inspect the land, and after taking all things into consideration I allowed for a rate reduction of 50 per cent. and felt fairly confident that 20 acres could be covered per day. The holes referred to, however, proved to be a very difficult matter indeed, consequently not more than 12 to 15 acres per day could be covered during the season under report. The matter however has my very careful attention and by making certain improvements in the implement I hope to get a much better result. This project is worked in association with the Collector of Kaira and my best thanks are due to him for his help in the matter, both before and throughout the season.

The haulage of coal and water was done by contract and not by hired carts as at Ranebennur. This system has been found to be far more effective and very much less expensive and

less troublesome. There certainly were some stoppages for coal and water during the season but I do not think that, taking such into consideration, we have lost more than 20 acres at the outside, or Rs. 240. Some improvements will be made this year in the terms of the contract to minimise stoppages in future.

Perusal of the balance sheet will show that the tackle has paid its way with 6¼% interest and the usual allowance for sinking fund for depreciation.

Repairs appear to be heavy but owing to the irregular surface the cultivator points were worn away rapidly and this item alone accounts for Rs 454-1-10, the remainder Rs 142-1-6 was for ordinary running repairs. The railway freight on the cultivator from Ranebennur to Dákore amounted to Rs. 280-9-0 and is included in miscellaneous charges.

Balance sheet of Kaira Steam Plough for the first year ending 30th June 1915.

Dr. *Cr.*

Particulars.	Amount.			Particulars.	Amount.		
	Rs.	a.	p.		Rs.	a.	p.
Establishment ...	1,699	11	6	Stores on hand ...	500	0	0
Miscellaneous office expenses.	4	14	7	Recoveries ...	9,926	6	3
Labour ...	382	3	0	Plant ...	42,500	0	0
Haulage of coal and water...	1,173	14	10				
Stores	2,061	11	9				
Repairs	596	12	6				
Coal	1,941	4	0				
Miscellaneous charges ...	397	7	9				
Tools and plants ...	194	8	0				
Interest	1,328	2	0				
Depreciation	610	0	0				
Capital	42,500	0	0				
Balance by profit ...	35	12	4				
Total ...	52,926	6	3	Total ...	52,926	6	3

Details of working.

The work with the cultivator was commenced with a single shift of men on 16th of March and continued upto 8th April when a double shift was organised and work was commenced in right earnest. We worked for 105 days in all and did 827 acres 8 gunthas and realised Rs. 9,926-6-. I also tried the disc plough as a second operation and did about 15 acres. The ploughing charges for the present season were fixed at Rs. 12 per acre, and I do not consider it advisable either to increase or reduce this rate until next season's work is over.

As the tackle worked for such a short time interest and sinking fund for depreciation are allowed for six months only, and establishment and other expenditure upto the end of June. The usual year for this project will be from 1st of July to 30th of June.

On enquiries I find that the cultivators like the work done with the cultivator immensely. The only improvement they suggest is less depth. This can be arranged in time to come if it is proved that shallow work is more beneficial.

Mr. Kagalwala, the Mámlatdár of Thasra, gave every assistance he possibly could and did much extra work to make this season a success. I am pleased to record that my staff also did good work and helped me considerably in making the tackle successful this season.

I hope to resume the ploughing operations during the last week in October, and continue until the middle of June, during this time much valuable work should be done.

STAFF.

I have been ably assisted throughout the year under review by my staff in carrying on the work enumerated under the various heads, and I desire to make special mention of the untiring efforts of my assistant, Mr. Paranjpe; my Head Clerk, Mr. Joshi; and my Boring Overseer, Mr. Chitale.

I have selected one of my best fitters, Mr. Rahatar, to take up the work of Shop Superintendent and I feel confident he will do good work.

The office work is increasing rapidly, for no less than 9,581 letters inward and outward have been dealt with during the year. Thirty-one estimates have also been prepared and submitted to the enquirers.

In the year 1913-14 the total number of letters was 6,835 and the number of estimates 20 from this some idea of the growth of the department will be obtained.

W. M. SCHUTTE,

Agricultural Engineer, Bombay Presidency,

Poona.

Particulars of bores taken in 1914-15.

Serial No.	Táluka.	Village.	Diameter of bore.	Particulars of site before boring commenced.	Depth of boring.	Water before boring.	Water after boring.	Cost of pipes and shoes, Mukadam's pay, Travelling Allowance and Bonus.	Labour charges.	Total cost per foot bore.	Remarks.
	Kaira District.		Inches.		Ft. In.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	Borsad	Bhawanipura ...	2½	.....	113 0	1 Kos.	1 Kos.	.....	.....	...	Incomplete by owner's request.
2	Do.	Vadeli ...	3	.....	78 0	1 „	7 „	98 13 3	56 8 0	2 0 0	Successful.
3	Do.	Kansari ...	3	.....	18 0	1 „	5 „	35 12 11	23 14 0	3 5 5	Do.
4	Do.	Rupiapura ...	2½	Well 62 ft. deep...	104 6	1 „	3 „	103 15 4	255 0 0	3 6 8	Do.
5	Mátar	Sokhda ...	2½	„ 33 „ ...	81 0	¼ „	1½ „	74 9 9	55 5 0	1 11 7	Do.
6	Do.	Ratanpur ...	2½	„ 45 „ ...	33 0	½ „	1½ „	34 0 5	20 13 0	1 10 7	Do.
7	Nadiád	Dabhan ...	2½	„ 54 „ ...	54 0	2 „	5 „	53 10 9	34 15 0	1 10 3	Do.
8	Anand	Napad ...	2½	„ 71 „ ...	33 0	1 „	3 „	34 1 4	27 10 6	1 14 0	Do.
9	Do.	Do. ...	2½	„ 73 „ ...	35 0	1 „	4 „	34 14 8	17 4 0	1 7 9	Do.
10	Nadiád	Kanjoda ...	2½	„ 68 „ ...	54 0	1 „	5 „	51 8 5	36 13 0	1 1 2	Do.
11	Do.	Do. ...	2½	„ 65 „ ...	77 0	1 „	5 „	71 7 8	57 4 0	1 10 9	Do.
12	Anand	Sarsa ...	2½	„ 90 „ ...	30 0	2 „	6 „	39 15 9	99 11 0	4 10 8	Do.
13	Nadiád	Kanjoda ...	2½	„ 74 „ ...	124 0	1 „	5 „	110 13 3	120 2 6	1 13 9	Do.
14	Mátar	Radhoo ...	2½	.....	42 0	...	.....	.....	.....	...	Unsuccessful.
15	Nadiád	Mahuda ...	3	Well 50 ft. deep...	72 0	...	.....	.....	.....	...	Do.
16	Do.	Do. ...	3	„ 50 „ ...	57 0	½ Kos.	1 Kos.	63 6 10	19 8 0	1 7 3	Successful.
17	Anand	Sarsa ...	2½	„ 80 „ ...	30 0	2 „	4 „	66 11 1	95 10 0	4 2 5	Do.
18	Do.	Do. ...	2½	.....	52 0	...	.....	.....	.....	...	Unsuccessful.
19	Do.	Do. ...	2½	.....	...	...	.....	.....	.....	...	In progress.
20	Nadiád	Kanjoda ...	2½	Well 53 ft. deep...	37 6	1 Kos.	5 Kos.	38 1 7	29 4 0	1 12 11	Successful.
21	Mátar	Radhoo ...	2½	.....	31 0	...	.....	.....	.....	...	Unsuccessful.
22	Anand	Anand ...	6	.....	84 0	*Nil*	350 gallons per hour.	696 7 10	87 7 0	9 5 4	Successful.
23	Do.	Do. ...	6	.....	...	...	.....	.....	.....	...	In progress.
24	Nadiád	Kanjoda ...	2½	.....	120 0	...	.....	.....	.....	...	Unsuccessful.
25	Do.	Do. ...	2½	Well 57 ft. deep...	80 0	1 Kos.	4 Kos.	67 1 5	33 0 0	1 4 0	Successful.
26	Do.	Shurasmal ...	2½	„ 51 „ ...	58 0	1 „	6 „	52 0 0	39 12 0	1 9 4	Do.
27	Do.	Do. ...	2½	„ 64 „ ...	20 0	1 „	4 „	33 12 10	59 11 0	4 11 2	Do.
28	Do.	Mahuda ...	3	„ 63 „ ...	170 0	½ „	2 „	200 9 8	155 15 0	2 2 4	Do.
29	Do.	Saloon ...	3	.....	...	...	.....	.....	.....	...	In progress.
30	Mátar	Radhoo ...	2½	.....	50 6	...	.....	.....	.....	...	Unsuccessful.
31	Borsad	Rupiapura ...	2½	Well 62 ft. deep ...	...	...	.....	.....	.....	...	In progress.
32	Do.	Jogan ...	2½	„ 66 ft. 6 in deep.	64 0	1 Kos.	5 Kos.	60 9 7	60 0 0	1 15 0	Successful.
	Ahmedabad District.										
33	Sanand	Charodi ...	3	Well 30 ft. deep ...	170 0	1 Kos.	960 gallons per hour.	252 2 3	214 14 0	2 12 0	Successful.
34	Dholka	Dholka ...	3	„ 36 „ ...	48 0	*Nil*	1 Kos.	59 3 11	37 3 0	2 0 0	Do.
35	Do.	Do. ...	3	„ 38 „ ...	25 0	*Nil*	2 „	38 0 10	22 2 0	2 6 5	Do.
36	S. Daskroi	Vehelal ...	4	„ 50 „ ...	52 0	¼ Kos.	1¼ „	90 12 10	34 8 0	2 6 6	Do.
37	Do.	Do. ...	4	„ 42 „ ...	40 0	¼ „	1¼ „	71 7 11	30 0 0	2 8 10	Do.
38	Do.	Nadej ...	4	„ 45 „ ...	56 0	*Nil*	2 „	86 14 8	0	2 12 5	Do.
39	Do.	Do. ...	4	„ 45 „ ...	34 0	*Nil*	½ „	64 1 0	19 8 0	2 7 6	Do.
40	Do.	Do. ...	4	„ 33 „ ...	24 0	¼ Kos.	1 „	62 3 4	39 0 0	4 4 0	Do.
41	Do.	Do. ...	4	„ 33 „ ...	69 0	½ „	1 „	127 3 3	55 0 0	2 10 3	Do.
42	Do.	Chhadswa or (Madalpur).	4	„ 43 „ ...	49 0	1 „	2 „	86 3 2	45 0 0	2 10 9	Do.
43	N. Daskroi ...	Uwarsad ...	2½	„ 47 „ ...	30 0	*Nil*	1 Kos.	34 10 1	25 6 0	2 0 0	Do.
44	Do.	Do. ...	2½	„ 50 „ ...	21 0	*Nil*	1 „	26 2 5	14 14 0	1 15 3	Do.
45	Do.	Do. ...	2½	.....	54 0	...	.....	.....	.....	...	Unsuccessful.
46	Do.	Do. ...	2½	Well 62 ft. deep...	64 0	1 Kos.	2 Kos.	63 7 8	82 8 0	2 9 0	Successful.
47	Do.	Do. ...	2½	.....	...	...	.....	.....	.....	...	Incomplete.
48	Do.	Do. ...	2½	Well 54 ft. deep ...	40 0	1 Kos.	2 Kos.	37 12 9	24 12 0	1 9 4	Successful.
49	Do.	Do. ...	2½	„ 45 „ ...	66 0	*Nil*	1 „	60 6 11	80 4 0	2 2 1	Do.

Serial No.	Táluka.	Village.	Diameter of bore.	Particulars of site before boring commenced.	Depth of boring.	Water before boring.	Water after boring.	Cost of pipes and shoes, Mukadam's pay, Travelling Allowance and Bonus.	Labour charges.	Total cost per foot bore.	Remarks.
	Surat District.		Inches.		Ft. In.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
50	Bardoli	Jamania	4	.....	6 0	*Nil*	.....	.....	... .	...	Unsuccessful.
51	Jalalpur	Amalsad	2½	.....	212 0	...	.....	.....	.....	...	Do.
52	Balsar	Bhagdakhurd ...	4	Well 27 ft. deep ...	70 0	½ Kos.	1½ Kos.	106 12 11	102 8 0	2 15 10	Successful.
53	Surat	Surat	4	„ 43 „ ...	30 0	2 „	14 „	55 11 10	50 4 0	3 8 6	Do.
54	Do.	Do.	4	.....	...	...	.....	.....	.....	...	In progress.
55	Choryasi	Rander	4	Well 50 ft. deep ...	20 0	½ Kos.	6 Kos.	43 0 3	30 3 0	3 12 10	Successful.
56	Do.	Do.	4	„ 56 „ ...	30 0	1 „	10 „	58 3 10	44 10 0	3 6 4	Do.
57	Do.	Do.	4	„ 40 „ ...	101 0	...	.....	.....	.....	...	Unsuccessful.
8	Do.	Do.	4	„ 40 „ ...	29 0	*Nil*	1 Kos.	70 4 2	120 0 0	6 8 11	Successful.
59	Do.	Do.	4	„ 58 „ ...	30 0	1 Kos.	5 „	67 1 4	47 11 0	3 13 4	Do.
60	Do.	Do.	4	„ 59 „ ...	90 0	*Nil*	1 „	133 11 7	205 14 0	3 12 4	Do.
61	Valod	Hathuka	4	.....	62 6	...	.....	.....	.....	...	Unsuccessful.
	Broach District.										
62	Jambusar	Jambusar... ...	2½	.....	110 0	*Nil*	.....	.....	.....	...	Unsuccessful.
	Thána District.										
63	Umbergaon Peta ...	Wase ...	3	Well 3 ft. deep ...	80 0	...	.....	.....	.....	...	On hand.
64	Salsette	Borivali ...	3	„ 30 „ ...	27 0	...	.....	.....	.....	...	Unsuccessful.
65	Umbergaon Peta ...	Wase ...	3	„ 6 „ ...	35 0	...	Not tested ...	16 13 6	35 0 0	1 7 9	Partially successful.
	East Khándesh.										
66	Jalgaon	Jalgaon ...	3	Well 48 ft. deep ...	27 0	...	Not tested ...	Not known.	.....	...	Successful, water flowing into the well.
	West Khándesh.										
67	Dhulia	Dhulia ..	3	.....	24 8	...	.....	.....	.....	...	On hand.
68	Do.	Do. ...	3	Well 42 ft. deep ...	165 0	...	120 gallons per hour.	37 0 6	223 2 0	1 9 3	Successful.
	Násik District.										
69	Násik ...	...	3	Pit 3 ft. deep ...	51 0	*Nil*	Not tested ...	28 3 6	134 6 0	3 3 0	Do.
70	Do.	Do. ...	3	„ 3 „ ...	100 0	...	.....	.....	.....	...	Unsuccessful.
71	Do.	Násik ...	3	Well 42 „ ...	...	...	.....	.....	.....	...	On hand.
	Poona District.										
72	Poona	Poona ...	3	.....	...	...	.....	.....	.....	...	On hand.
73	Do.	Do. ...	3	From surface ...	79 0	*Nil*	1,500 gallons per hour.	Not known.	.....	...	Successful.
74	Do.	Do. ...	3	Pit 5 ft. deep ...	75 0	*Nil*	1,500 do.	21 3 7	86 4 0	1 4 7	Do.
75	Do.	Do. ...	3	From surface ...	150 0	...	120 do.	43 0 2	262 8 0	2 0 7	Do.
76	Do.	Do. ...	3	.....	51 0	...	1,400 do.	19 12 6	37 8 0	1 1. 9	Do.
77	Do.	Do. ...	3	Well 42 ft. deep ...	50 0	...	.....	.....	.....	...	Unsuccessful.
78	Do.	Do. ...	3	From surface ...	80 0	*Nil*	480 gallons per hour.	54 6 1	131 4 0	2 6 0	Successful.
	Sátára District.										
79	Valva	Chikurda ...	3	Well 29 ft. deep ...	80 0	...	.....	.....	... ..	...	Unsuccessful.
80	Do.	Aitawda ...	3	„ 35 „ ...	43 0	*Nil*	Not tested ...	20 1 6	65 0 0	1 15 7	Successful, water flowing into the well.
81	Do.	Do. ...	3	„ 22 „ ...	30 0	...	.....	.....	.....	...	On hand.
82	Koregaon	Dahiwadi ...	3	„ 6 „ ...	17 0	...	.....	.....	.....	...	Do.
	Belgaum District.										
83	Gokak	Arbhavi ...	3	Surface ...	42 0	...	.....	.....	.....	...	Successful, was abandoned owing to tool mishap.
84	Do.	Do. ...	3	.....	154 0	*Nil*	Not tested ...	82 1 0	181 4 0	1 11 5	Successful.
	Bijápur District.										
85	Indi	Agarkhed ...	3	Well 26 ft. deep ..	51 0	*Nil*	1,500 gallons per hour.	13 0 0	31 4 0	0 13 10	Successful.
86	Do.	Do. ...	3	„ 26 „ ...	51 0	*Nil*	Do. ...	12 10 11	34 6 0	0 14 7	Do.
87	Do.	Do. ...	3	„ 45 ...	30 2	*Nil*	Do. ...	15 13 6	43 12 0	1 10 5	Do.
88	Do.	Do. ...	3	„ 20 „ ...	33 3	*Nil*	Do. ..	10 7 8	31	1 4 4	Do.
89	Do.	Do. ...	3	„ 20 „ ...	29 3	*Nil*	Do. ...	11 9 2	25 0 0	1 4 5	Do.
90	Do.	Do. ...	3	„ 30 „ ...	32 0	*Nil*	Do. ...	12 2 10	37 0 0	1 8 7	Do.
91	Do.	Do. ...	3	Surface ...	60 0	...	.....	.....	.....	...	Unsuccessful.
92	Do.	Ahirsang ...	3	Well 10 ft. deep ...	54 0	...	.....	.....	.....	...	Do.
93	Do.	Indi ...	3	„ 30 „ ...	26 0	...	.....	.....	.....	...	On hand.
94	Bagalkot	Shirur ...	3	Surface ...	18 0	...	.....	.....	.....	.....	Do.

Serial No.	Táluka.	Village.	Diameter of bore.	Particulars of site before boring commenced.	Depth of boring.	Water before boring.	Water after	Cost of pipes and shoes, Mukadam's pay, Travelling Allowance and Bonus.	Labour charges.	Total cost per foot bore.	Remarks.
	Dhárwár District.		Inches.		Ft. in.			Rs. a. p.	Rs. a. p.	Rs. a. p.	
95	Karajgi	Devihosur ...	3	Surface ...	50 0	*Nil*	Not tested ...	7 5 0	18 12 0	0 8 4	Successful.
96	Do.	Do. ...	3	,, ...	40 0	...	.....	.....	.....	...	Incomplete.
97	Do.	Do. ...	3	,, ...	63 0	...	.....	.....	.....	...	On hand.
98	Ron	Alur ...	3	,, ...	44 0	...	.....	.....	.....	...	Do.
	Kolába District.										
99	Alibág	Alibág ...	3	Well 30 ft. deep...	30 0	...	.....	.....	.....	...	On hand.
	Kánara District.										
100	Koompata	Koompta ...	3	Surface ...	30 0	...	.....	.....	.....	...	On hand.
	Sholápur District.										
101	Bársi	Pangri ...	3	Surface ...	40 0	...	1,500 gallons ...	40 9 9	50 0 0	2 4 2	Successful.
102	Do.	Do. ...	3	Well 28 ft. deep...	40 0	...	.....	.....	.....	...	Unsuccessful.
103	Pandharpur ...	Temburni ...	3	Surface ...	200 0	...	.....	.....	.....	...	Do.
104	Kármala	Kármala ...	3	,, ...	100 0	...	.....	.....	.....	...	Do.
105	Do.	Do. ...	3	,, ...	43 0	...	.....	.....	.....	...	On hand.
	Out of the Bombay Presidency.										
106	Panhala	Kodoli ...	3	Well 30 ft. deep...	50 1		3,000 gallons per hour.	18 0 9	65 0 0	2 1 7	Successful.
107	Do.	Do. ...	3	,, 28 ,, ...	40 2	*Nil*	1,500 ,, ...	13 14 4	50 0 0	1 4 5	Do.

Note.

Year.	Number of enquiries.	Number of bores taken.	Percentage of successes in Gujarát.	Percentage of successes in Deccan.	Total percentage o success.
1913-14	169	38	70·56	61·53	66·66
1914-15	270	107	78·1	70·	75·2

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